MINERAL DEVELOPMENT DIVISION
DEPARTMENT OF MINES AND ENERGY
GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

REPORT OF ACTIVITIES FOR 1986

St. John's, Newfoundland
1986

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Editing and Compilation

Senior Geologist: R.V. Gibbons

Editor: R.F. Blackwood

Drafting Supervisor: K. Byrne

Word Processing: Joanne Rooney
Deb Downey
Judy Morgan
Doreen Peavy
Judy Lynn Reid
Bev Strickland

Drafting: D. Leonard
T. Paltanavage
K. Steinhauer

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Compiled by
R. Frank Blackwood

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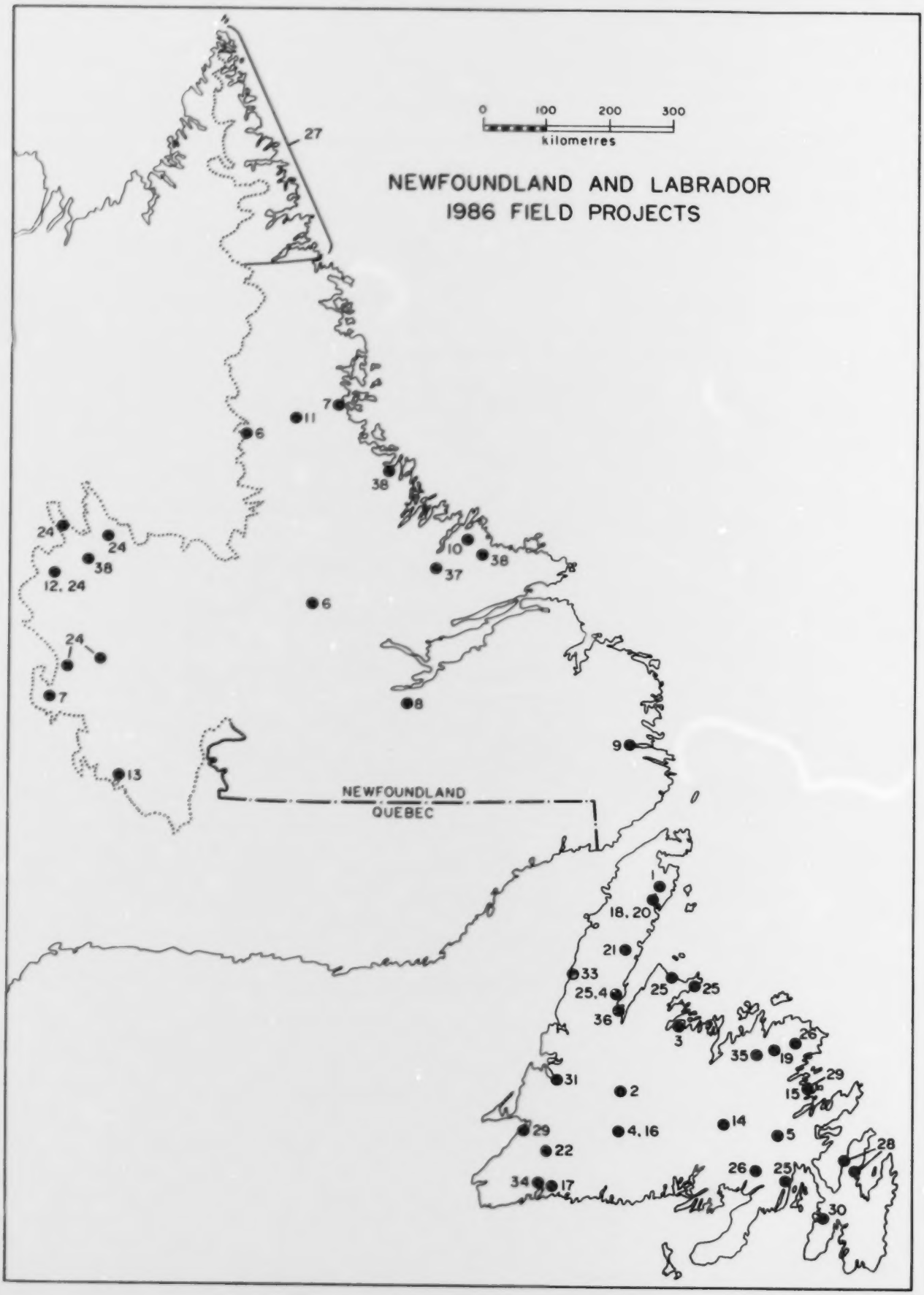
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NEWFOUNDLAND AND LABRADOR
1986 FIELD PROJECTS
NEWFOUNDLAND
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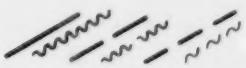
GEOLOGICAL MAP SYMBOLS

Geological contact (defined, approximate, assumed, gradational)

Fault (defined, approximate, assumed)



Thrust fault (defined, approximate, assumed)

Zone of numerous imbricate thrust faults

Bedding, tops known (horizontal, inclined, vertical, overturned)

Bedding, tops unknown (horizontal, inclined, vertical, dip unknown)

Pillow bedding, tops known (inclined, vertical)

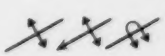
Flow banding (inclined, vertical)

Fracture cleavage (inclined, vertical)

Syncline, showing direction of plunge (defined, approximate)

Anticline, showing direction of plunge (defined, approximate)

Antiform (horizontal, plunging, overturned)



Synform (horizontal, plunging, overturned)

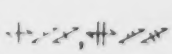
Minor fold axis (with plunge)

S folds, Z folds

Gneissic foliation (horizontal, inclined, vertical, dip unknown)

Schistosity, cleavage, foliation (horizontal, inclined, vertical)

S_1, S_2



Foliation due to thrusting (inclined, vertical)

Lineation, fold axis, mineral rodding

Jointing (horizontal, inclined, vertical)

Primary igneous layering (inclined)

Shear zone (approximate)

Alteration zone

Unconformity

Contact inferred from magnetic anomaly

Glacial striae

Drift covered area

Topographic lineaments from aerial photographs

Road

Power transmission line

Mine Pb

Mineral Occurrence × Zn

Location of measured section

Abbreviations

Arsenopyrite	asp	*Iron formation*	*i-f*
Asbestos	asb	*Magnetite*	*mag*
Chalcopyrite	cp	*Molybdenite*	*mo*
Copper staining	cs	*Pyrite*	*py*
Fluorite	fl	*Pyrrhotite*	*po*
Galena	gn	*Radioactive minerals*	*ra*
Hematite	hem	*Serpentine*	*sup*
		Sphalerite	*sp*

Chemical symbols are used for elements, e.g. Cu.....copper.

ECONOMIC GEOLOGY

Marble assessment in the Roddickton area of the Great Northern Peninsula, Newfoundland

by

Ambrose Howse
Mineral Deposits Section

Introduction

An assessment of Newfoundland's marble resource began in 1985 and continued in 1986. The project's aim is to determine the potential value of marble for such industrial applications as fillers, whiteners and dimension stone. The 1985 survey involved extensive sampling of marble prospects in western Newfoundland. Emphasis was focused on high-calcium marbles because of their potentially high value in the filler industry. All of the 1985 samples were chemically analyzed, and selected samples were tested to determine whiteness and brightness qualities. This work identified several promising areas, the most interesting of which are located in the Canada Bay - Roddickton area of the Great Northern Peninsula (Figure 1). In this area, deposits of marble occur along strongly deformed zones within parautochthonous St. George Group carbonate rocks underlying the Hare Bay allochthon (Knight, 1984). One of these prospects (the Penny's Pond deposit) was subjected to detailed follow-up work in 1986, consisting of a diamond-drilling program and detailed mapping. During the course of this work, other deposits of white marble were identified in the region and similarly tested.

Highlights of the 1986 program included:

a. Delineation by drilling of a significant deposit of high-purity white marble near Penny's Pond on the Conche Road.

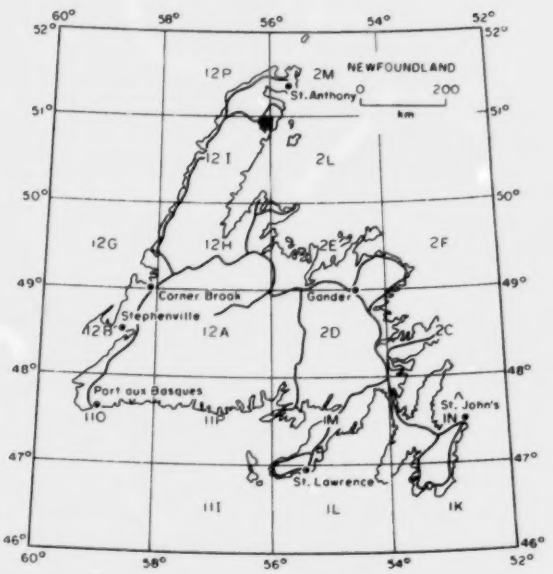


Figure 1: Location of marble assessment area - 1986.

b. Identification of new deposits of high-purity white marble about 5 km northeast of the Penny's Pond deposit. These were also partially tested by diamond drilling.

Penny's Pond Deposit

White, high-calcium marble is exposed on both sides of the Conche highway (Route 432) about 3.5 km east of its junction with the main Roddickton-Englee highway (Route 433). The south-trending, eastward-dipping (50°) zone strikes across

the highway and dips beneath Penny's Pond (Figure 2). The marble is also exposed in the bed of a short access road that leads from Route 432 to Penny's Pond. Chip samples taken from these outcrops in 1985 showed the presence of high-calcium stone that is low in abrasiveness, as required for use as mineral fillers. Tests also showed that the marble has a high degree of whiteness and brightness, essential qualities for high-grade fillers (Table 1).

Table 1. Average results of nine chip samples collected across the Penny's Pond deposit

	Percentage
CaO	55.1
Al_2O_3	0.14
MgO	0.28
SiO_2	0.75
Dry brightness index	96.0
Whiteness index	96.6

Follow-up work on the Penny's Pond deposit in 1986 involved a diamond-drilling program designed to test the continuity, quality and dimension of the deposit. The drilling produced 718 m of AQ drill core from 11 holes, all of which were inclined at 45° and drilled in a westerly direction in order to intersect the marble formation perpendicularly.

The 11 holes (spaced at 40 m intervals) traced the marble along strike southward from Penny's Pond. The color of the marble varies from ivory to white, but it powders easily to a fine white material. It has an extremely fine grained to aphanitic texture. The main contaminant in the marble is chlorite, which occurs as thin coatings along fractures and in bands of carbonate schist several centimetres thick. Other impurities include sericite in very minor amounts along some fractures, and rare quartz. There are, however, bands of pure white marble that have no apparent contamination, and range up to several metres thick.

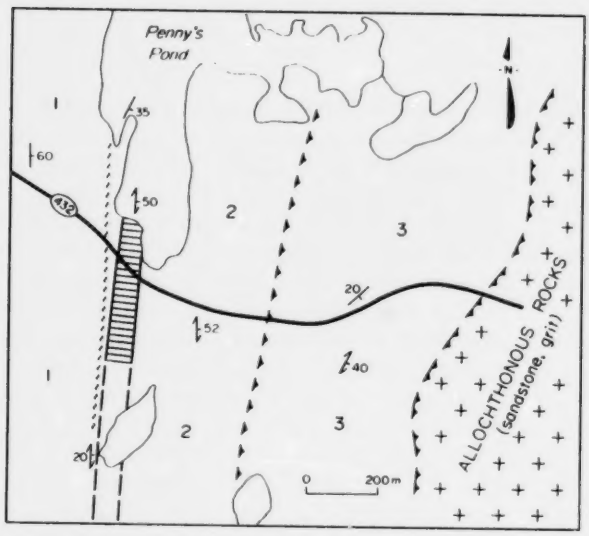
The Penny's Pond drilling traced the marble zone southward from Penny's Pond for 450 m. However, the deposit extends farther southward beyond the limit of the drilling. The south-striking zone of white marble exposed in Marble Brook some 5 km to the south (Howse, 1985) appears to be part of the same belt of marble.

New Marble Prospects

New deposits of high-purity white marble were identified northeast of Penny's Pond in 1986. Located in the area just south of Coles Pond, about 8 km north of the Conche highway, these deposits were exposed by the construction of woods roads and related activity. The marble appears to form a synclinal structure, which is underlain by gray dolomitic marble and interbedded limestone (Figure 3). Three areas were tested by diamond drilling. Eight holes totalling 354 m were drilled on the western limb of the structure. One hole tested a section of the east limb, and a 47-m hole tested a vein of white, coarsely crystalline calcite on and near Coles Brook, apparently along the axis of the syncline. In the following brief descriptions, these prospects are informerly referred to as the Coles Pond east and west deposits and the Coles Brook calcite deposit.

Coles Pond west deposit

This deposit is sporadically exposed along a northeast-trending ridge. It consists of gently dipping, cleaved marble (035/30SE) that has a color varying through shades of ivory and blue. It has an extremely fine grained to aphanitic texture, and breaks easily, producing a white powder.



LEGEND

3 Blue marble

2 Marble, minor dolomite; 2a, white marble zone

1 Crystalline dolomite marble

SYMBOLS

Geological contact.....

Bedding (inclined, vertical)...

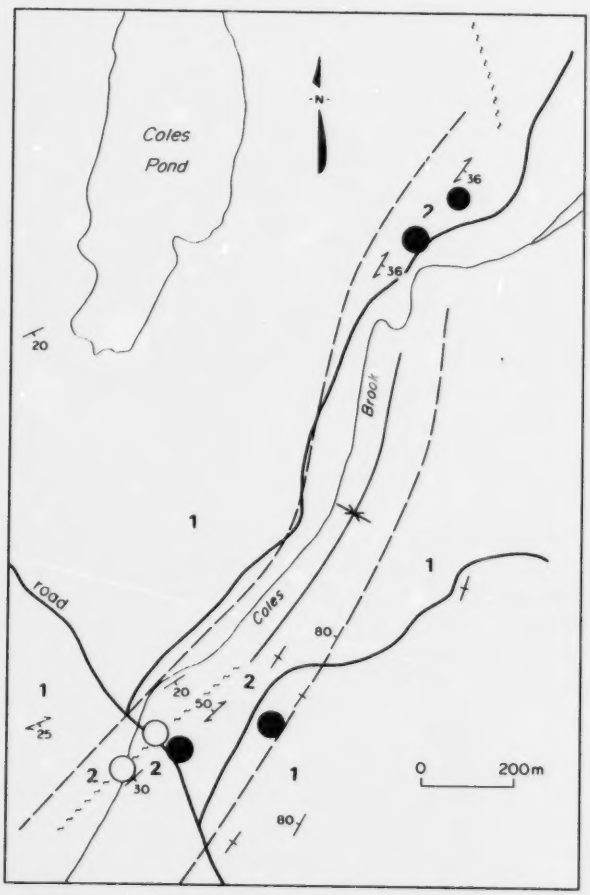
Cleavage (inclined, vertical)..

Fault (assumed).....

Thrust fault (approximate, assumed).....

Drilled area.....

Figure 2. Geological sketch map of the Penny's Pond area; geology in part after Knight et al. (1979).



LEGEND

2 White marble

1 Dolomite marble, limestone

SYMBOLS

geological contact (approximate).....

cleavage (inclined, vertical)..

bedding (inclined, vertical)...

syncline.....

marble prospect.....

calcite prospect.....

Figure 3. Geological sketch map showing the location of exposed white marble and calcite south of Coles Pond.

Eight holes (45 m, average depth) were spaced at 40 m intervals along the base of the ridge and drilled in a northwesterly direction normal to the trend of the zone. The results confirmed the predominantly white marble composition of the ridge, but drill core also showed sections of interbanded, mottled and cloudy, gray-blue limestone and marble. In the last two holes drilled at the northeast end of the ridge, this type of rock is predominant.

The deposit, like the Penny's Pond prospect, contains thin bands of chlorite along cleavage planes. Very rare quartz in a calcite matrix was also noted. The presence of these minerals gives a cloudy or mottled appearance to some sections of white marble.

Coles Brook east deposit

A 82-m hole was drilled in a southeastward direction (45°) to test an area on the east side of Coles Brook where sections of white marble are exposed. Bedding features are not evident in the marble, but the presence of thin beds of dolomite in the section indicate a steep (80°) westward dip.

The drill core shows high-purity white marble interbanded with chlorite-carbonate schist. The schist bands range up to 2 m wide and are fairly widely separated. Interbanded with the purer marble are sections containing thin streaks of chlorite ranging up to 1 cm in width. The cumulative total of pure white marble cut by the drill hole is 17 m.

The apparent extension of this zone of white marble is exposed on both sides of a woods road, approximately 300 m to the southwest of the drillhole location. It also outcrops at the site of an abandoned sawmill, about 150 m north of the hole.

Coles Brook calcite deposit

This hole tested a somewhat unique deposit of white crystalline calcite, which forms the east bank of Coles Brook just south of the road bridge, and outcrops on both sides of the road about 100 m along strike, northeastward from the brook exposures. DDH-13 was drilled near the road outcrops and inclined steeply westward (70°). Core recovery in this hole was not good, especially in the top calcite sections, due to the soft and fractured condition of the rock. The hole was drilled through 5.4 m of coarsely crystalline calcite, but from that depth to 8.4 m the core was ground up and not recovered. It is reasonably certain, however, that this lost core was also in calcite. The recovered core consists of coarse grained crystal aggregates of calcite that is white in color but, in part, has light-green and blue stains. Calcite marble containing several multi-colored schistose zones was intersected from 8.4 m to 16.9 m, and white marble in which a blue-gray tint increases downward was encountered from 16.9 m to 28.2 m. The hole ended in interbanded blue-gray limestone and marble and light-gray marble.

Drill core samples from the 1986 program are being analyzed by the Department of Mines and Energy geochemical laboratory. Selected representative samples will also be tested for whiteness and brightness qualities.

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Metallogenic Studies, Victoria Lake Group

by

B.F. Kean and D. Evans
Mineral Deposits Section

Introduction

The field component of a program initiated in 1984 to investigate the metallogeny of the Victoria Lake Group was completed this year. Geochemical and petrographic studies will be conducted over the next two years. A final report and a colored metallogenic map of the Central Mobile Belt (in conjunction with H.S. Swinden of the GSC) will be published in 1989.

Field work during 1986 consisted of basically three components: (1) regional and detailed mapping of selected areas of the Victoria Lake Group, with emphasis on the Tulks Hill volcanics; (2) study of volcanogenic sulfide mineralization; and (3) a detailed examination of the B.P.-Selco Au prospect at Midas Pond at the southwest end of the Tulks Belt.

Regional Geology

The Early Ordovician Victoria Lake Group extends from Grand Falls southwestward to King George IV Lake. The group is a pre-Caradocian "island-arc-type" sequence, consisting of felsic and mafic volcanic rocks, and volaniclastic and epiclastic rocks, which can be divided into two major regional facies (Kean, 1985): (1) a sequence of mafic and felsic volcanic rocks represented by the Tally Pond and Tulks Hill volcanics in the southeast and southwest respectively; and (2) a laterally equivalent, predominantly clastic, sedimentary rock sequence occurring in the northeast (Fig. 1). The Tulks Hill and the Tally Pond volcanics are host to numerous showings including six major sulfide prospects or deposits, and a significant Au prospect. The major sulfide occurrences are the Victoria Mine, Jacks Pond, Tulks East and Tulks Hill, all within the Tulks Hill volcanics, and the Tally Pond (Boundary) deposit and Burnt Pond prospect in the Tally Pond volcanics. The Au prospect occurs at Midas Pond, located at the southwest end of the Tulks Belt.

In the southwest, the Victoria Lake Group is interpreted to overlie the Annieopsquotch ophiolite complex. To the north, the volcanic sequences of the Victoria Lake Group are conformably overlain by Middle Ordovician(?) sedimentary rocks of the Harbour Round Formation, whereas to the northeast, the clastic sedimentary rock facies is conformably overlain by Caradocian black shales and chert. The Victoria Lake Group along its southern margin is unconformably overlain by the Silurian(?) Rogerson Lake Conglomerate.

Mapping

Geological mapping of new road exposures and detailed mapping of the shoreline exposures along Bobbys Pond, North Pond and Beatons Pond were conducted. Detailed mapping in the vicinity of the Victoria Mine was also carried out. Geological contacts and subdivision of units were considerably resolved in these local areas.

Twenty-three samples of mafic flows were collected from the Tulks Hill volcanics, thus completing the sampling of the Victoria Lake Group for petrochemical studies.

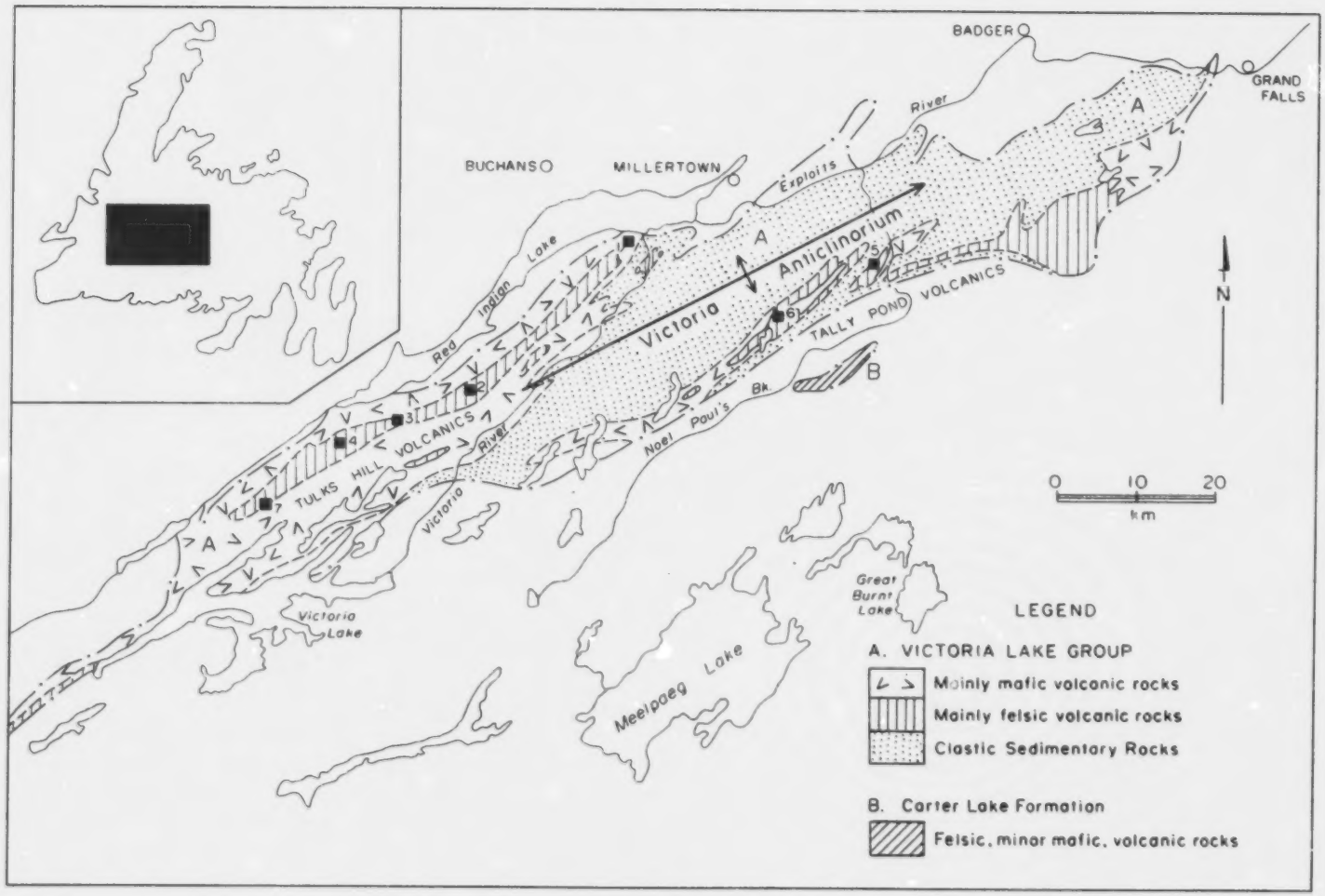

Figure 1: Early to Middle Ordovician volcanic-dominated island-arc sequences and associated mineralization (solid squares) in central Newfoundland (after Swinden and Thorpe, 1984). Mineral prospects: 1. Victoria Mine; 2. Jacks Pond; 3. Tulks East; 4. Tulks Hill; 5. Burnt Pond; 6. Tally Pond; 7. Midas Pond.

LEGEND

8 Fine grained, gray, synvolcanic gabbro

7 Variably sheared and altered, felsic and intermediate to mafic, crystal-lithic tuff

6 Banded mafic volcanic rocks

5 Intensely silicified felsic tuff

4 Green, felsic, feldspar-crystal, tuff

3 White to blue-green, sericitic, felsic, quartz ± feldspar-crystal tuff

2 Coarse felsic breccia and mafic to intermediate, feldspar-crystal tuff

1 Fine grained, gray-green, mafic to intermediate, feldspar-crystal tuff and minor breccia

SYMBOLS

Zone of intense pyrophyllitization

Mineralized zone

Shear zone boundary

Geological boundary (approximate, gradational)

Fault (assumed)

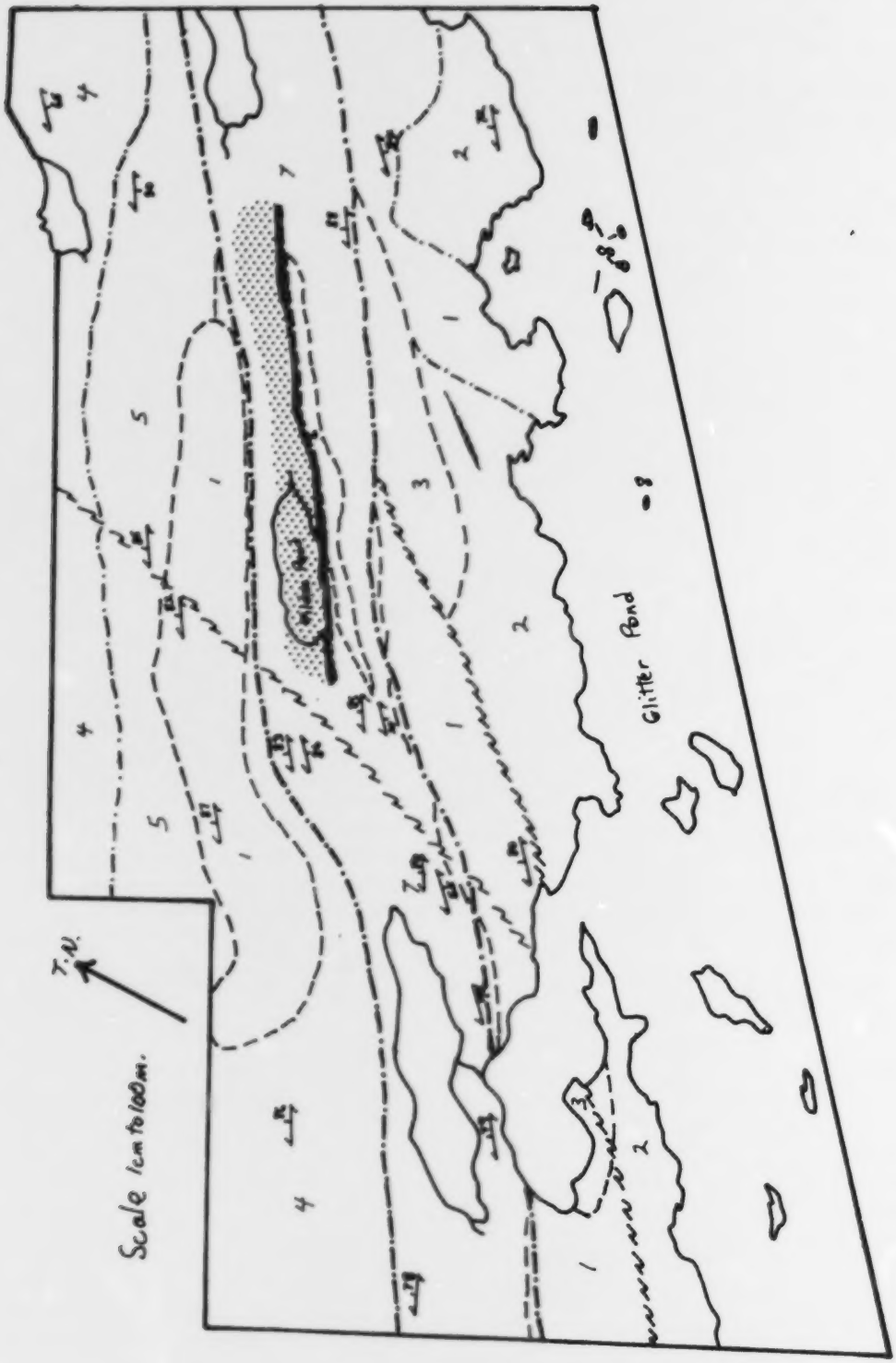

Figure 2: Geology of the Midas Pond Au prospect.

Mapping of a small area around Sandy Lake, Noel Pauls Brook map area (12A/9), indicate that the mafic volcanic rocks of the Diversion Lake area are probably in fault contact with the Tally Pond volcanics, and, in keeping with their contrasting geochemical signatures (H.S. Swinden, personal communications 1985), probably should not be correlated.

Economic Geology

Mineralization in the Victoria Lake Group is mainly of volcanogenic type, including both stratiform massive sulfides and stockwork. During the 1986 field season, the Victoria Mine and two prospects of confidential status were examined, mainly in drill core. Also the Midas Pond epithermal gold prospect was examined in detail as part of a proposed M.Sc. thesis project by D. Evans.

Victoria Mine Prospect. The copper-zinc-lead showings at the "Victoria Mine" near the mouth of Victoria River were discovered in 1905. Subsequent exploration efforts have failed to delineate an economic deposit.

The showings are hosted by altered felsic volcanics of the Middle Ordovician Tulks Hill volcanics. The felsic volcanics consist of sericitized, green to buff, lithic, dacitic tuff and lapilli tuff, locally containing small quartz eyes. The host felsic volcanics are enclosed by a bedded sequence of gray, green, and locally maroon, lithic, intermediate tuff and lapilli tuff, and tuffaceous sediments.

Mineralization at "Victoria Mine" consists of banded massive and disseminated pyrite and chalcopyrite, locally containing sphalerite and galena. Zones of banded to heavily disseminated lead-zinc overlie the chalcopyrite-rich zones, and are generally associated with massive dolomite(?) and dolomite(?) veins.

The host felsic volcanics display varying degrees of sericitization, chloritization and pyritization. Quartz, quartz-carbonate and dolomite veins are developed throughout the host rock types. The alteration appears to be stratiform.

Midas Pond Au Prospect. Detailed mapping and sampling was carried out on the Midas Pond Au prospect, discovered in 1985 by B.P. Selco (Figure 2). The prospect occurs in a complex northeast-southwest-trending ductile shear zone developed in fine grained, buff-to white-weathering, felsic, crystal-lithic, lapilli tuff, and fine grained, green-grey, mafic to intermediate, feldspar-crystal, tuff and breccia. Extensive zones of pyrophyllitization, sericitization and silicification are developed in the shear zone. In combination with the shearing, this alteration all but obliterates the original rock textures. The shear zone consists of an anastomosing system of small shears enclosing more competent, usually silicified, felsic to intermediate, crystal-lithic, lapilli tuffs.

The mineralization consists of assay gold values with traces of silver, hosted by coarse grained, milky-white quartz veins. Base metals are all but absent from the area, and only trace values are present. The quartz veins generally occur in a silicified zone adjacent to, and intimately associated with, a structurally underlying banded mafic rock unit of probable tuffaceous origin. The banded rock unit consists of alternating dark-green chloritic bands and rusty, limonitic felsic bands, which vary up to approximately one to two centimetres in width.

There are three generations of quartz veining in the mineralized zone. The oldest veins are approximately parallel to the main shear fabric and exhibit well-developed boundinage features. The second and third generation quartz veins cut the first vein system and the shear fabric. They consist of apparently strain-free, milky-white quartz crystals that exhibit comb structures, suggesting that the veins were emplaced after the shear-zone development. Coarse patches of pyrite, pale-green, fine grained paragonite, and cream to buff pyrophyllite are commonly associated with the veins. It hasn't been determined yet which generation of quartz veins hosts the gold.

Structurally above the zone of quartz veining is a zone of extensive, highly cleaved, pyrophyllitization and minor silicification. Fine veinlets of fluorite and patches of paragonite are locally developed throughout this zone. The prospect is interpreted to have formed in an epithermal-type environment prior to or during the development of a ductile shear zone.

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Metallogeny of the Buchans-Roberts Arm Belt

by

H. Scott Swinden
Geological Survey of Canada

INTRODUCTION

The "Buchans-Roberts Arm belt" is an early Ordovician volcanic, subvolcanic and volcaniclastic sequence in the north-central part of the Dunnage Zone, central Newfoundland. During the 1986 field season, studies were continued in the second year of a four-year project to investigate the metallogeny of this belt.

Swinden and Sacks (1986) summarized the initial results of this project, outliring the stratigraphic succession and providing a stratigraphic framework for volcanogenic mineralization in the southern part of the Robert's Arm Group. Field mapping during 1986, concentrated in the central part of the Robert's Arm Group between the Handcamp Prospect and Highway 380 (Figure 1), was aimed at tracing geologic units from the limit of 1985 mapping northward to the southern limit of Bostock's (1978) mapping of the northern part of the Robert's Arm Group. Particular attention was paid to the western side of this area between Hall Hill and Halls Bay in an attempt to reconcile geological relationships portrayed by Currie (1975, 1976) and Bostock et al. (1979) with those of Dean and Strong (1976) and Kean et al. (1981). The former authorsproposed that the Robert's Arm Group in this area is in fault contact to the west with an older mafic intrusive complex (the Hall Hill Complex) and a dominantly plagiogranite suite (the Mansfield Cove Complex); the latter authors assigned these mafic rocks to the Robert's Arm Group and interpreted the Mansfield Cove Complex (termed by them the "Halls Bay Pluton") as intrusive into the Ordovician volcanic sequence.

The 1986 mapping shows that the Robert's Arm Group can be traced continuously from the southern limit of Bostock's (1978) mapping to the area of the Handcamp Prospect (Figure 1). Outcrop is not sufficiently abundant to trace the southern Robert's Arm Group stratigraphy through this area, although elements of this stratigraphy can be recognized locally. The mapping has further outlined the extent of the Hall Hill Complex (Currie, 1976), which has now been traced from Halls Bay to the area northwest of Great Gull Pond. This complex consists dominantly of fine grained diabase and medium to coarse grained equigranular gabbro. However, it contains sheeted dykes with screens of gabbro and pillow lava, and minor intrusive phases such as pegmatitic gabbro, pyroxenite and plagiogranite - elements typical of ophiolitic plutonic sequences elsewhere in Newfoundland. Intrusive relationships suggest that it is approximately coeval with the Mansfield Cove Complex to the north, and the two together are tentatively interpreted to represent Ordovician oceanic crust, which may have formed basement to the Robert's Arm Group.

Following completion of the mapping, examination of mineral occurrences in the central and northern parts of the Robert's Arm Group was carried out with the aim of documenting their geological relationships and sampling them for geochemical analysis. The best known deposits in this area are at Pilley's Island, where a complex hydrothermal

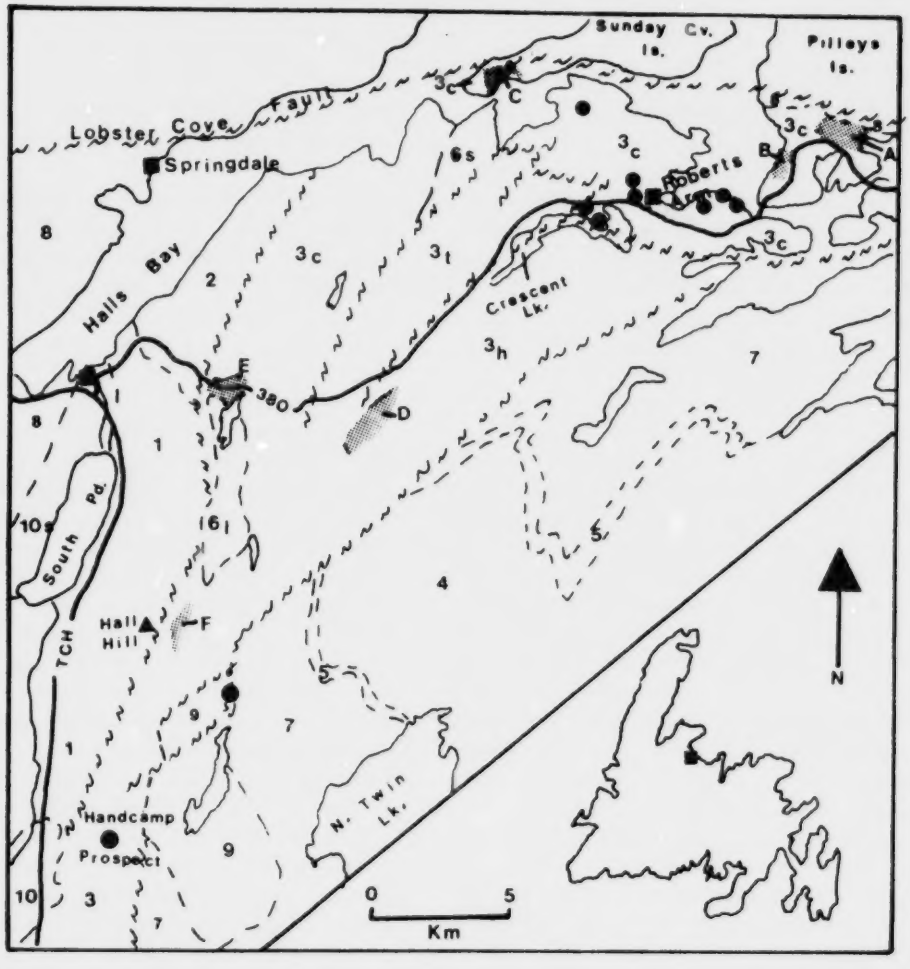

Figure 1. General geology, volcanogenic alteration zones and mineral occurrences in the central and northern parts of the Robert's Arm Group. Alteration zones are shown in dark stipple: A - Pilley's Island; B - Spencer's Dock; C - Sunday Cove Tickle; D - Rust Pond - Round Pond; E - Loon Pond; F - Hall Hill East. Solid dots are sulfide occurrences without extensive alteration zones. Geology in part simplified after Bostock (1978) and Kean et al. (1981). Chemical classification of volcanic rocks in the northern part of the Robert's Arm Group is after Bostock (1978).

LEGEND

DEVONIAN(?)

10 Posttectonic granitoid rocks; 10s, South Pond Pluton

9 Mafic to intermediate plutonic rocks, probably related to the Twin Lakes Complex

SILURIAN

8 Springdale Group: dominantly subaerial volcanic and sedimentary rocks

ORDOVICIAN-SILURIAN

7 Sansom Greywacke: volcanically derived graywacke, lesser argillite, conglomerate

6 Granitoid rocks: may be subvolcanic to Robert's Arm Group; 61, Loon Pond granite; 6s, Sunday Cove granite

5 Shoal Arm Formation: black argillite and chert - the "Caradocian shale"

4 Wild Bight Group: dominantly volcanically derived turbidites, debris flows, lesser mafic volcanic rocks

3 Robert's Arm Group: mafic to felsic volcanic rocks, lesser volcanically derived volcaniclastic rocks, minor chert; 3c, dominantly calc-alkaline mafic volcanic rocks, abundant felsic volcanic rocks, lesser turbidites; 3t, dominantly tholeiitic mafic volcanic rocks, lesser turbidites, chert; 3h, "high-Ti" tholeiites, abundant interbedded turbidite, chert (includes the Crescent Lake Formation).

2 Mansfield Cove Complex: dominantly plagiogranite, lesser granodiorite, mafic plutonic and hypabyssal intrusive rocks, minor mafic volcanic rocks

1 Hall Hill Complex: dominantly mafic intrusive rocks; diabase, gabbro, minor pegmatitic gabbro, plagiogranite, mafic volcanic rocks

alteration and massive sulfide system is associated with an extrusive dacite dome. The massive sulfides were mined for pyrite around the turn of the century. Several minor occurrences between Pilley's Island and Sunday Cove Island were examined in detail to compare them with the Pilley's Island deposits and investigate the relationship, if any, between them. In addition, numerous minor occurrences previously reported in the area southwest and west of Crescent lake were visited, their geologic setting documented, and samples taken for base- and precious-metal analyses.

The volcanogenic mineralization is mainly concentrated in the calc-alkaline volcanic series of Bostock (1978). Mineralization immediately west of Pilley's Island is interpreted as a distal expression of the hydrothermal system exposed there. However, the relatively intense alteration and mineralization at Sunday Cove Tickle may be a separate, although temporally related, hydrothermal cell. Mineralized vein systems in the Crescent Lake area are interpreted as a deeper-level manifestation of the Pilley's Island hydrothermal cell. Lean pyritic stockwork associated with quartz-sericite alteration of pillow basalt in the Rust Pond - Round Pond area is the only significant volcanogenic mineralization hosted by high-Ti basalts (Bostock, 1978).

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Metallogenesis of granitoid rocks in Newfoundland

by

J. Tuach and P. Delaney
Mineral Deposits Section

During the 1986 field season, work was concentrated in the Granite Lake area of central Newfoundland (NTS 12A/2, 12A/7). Five exploration companies were involved in exploration for molybdenum, tungsten, and uranium in this area during the period 1979 to 1982, following the definition of lake sediment anomalies by government surveys. The area is poorly exposed and the present work involved compilation of geochemical and geological data from assessment files, and resampling of all available outcrop with emphasis on mineralized and altered zones. Approximately 200 samples were collected and will be analyzed for a large suite of elements, including gold and silver.

A compilation map showing the geology and mineral occurrences in the Granite Lake area is presented in Figure 1. Gneisses and migmatites (Unit 1) were intruded by banded and foliated granodioritic rocks (Unit 2), and both units may be Ordovician to Silurian in age. These rocks were in turn intruded by unfoliated, Devonian granitoid rocks: Unit 3 is a buff, medium grained, equigranular, biotite-muscovite granite, and Unit 4 is a pink to red, medium to coarse grained, muscovite-biotite granite. Mineralization is associated with the pink to red muscovite-biotite granite (Unit 4). Exocontact-style mineralization consists of east-trending, subvertical, quartz and quartz-feldspar veins (simple pegmatite), and quartz-muscovite greisen sheets containing coarse grained wolframite and locally, traces of scheelite and molybdenite. Similar vein sheets containing coarse grained wolframite and locally abundant molybdenite-rich selvages occur within Unit 4. These latter veins may dip eastward at a low angle, although this is not definitive due to poor exposure. The zonal arrangement of mineralization is emphasized by the distribution of the reported mineralized boulders in the area (Figure 1), which are found over an area of approximately 20 km2.

Additional mapping and sampling were carried out in the Jackson's Arm - Sops Arm areas (NTS 12H/10, 12H/15). The most significant discovery was the location of boulders of potassium-feldspar-rich granitic rocks, which are thought to form part of the Jackson's Arm alteration system, within EoCambrian conglomerate.

LEGEND

DEVONIAN(?)

4 Medium to coarse grained, equigranular to porphyritic, pink to red, biotite-muscovite granite

3 Medium grained, equigranular, white to buff, biotite-muscovite granodiorite

ORDOVICIAN-SILURIAN(?)

2 Foliated, banded, medium grained, pink to gray, biotite-granodiorite

1 Migmatite and schist

Symbols

Geological contact (approximate, assumed)
Fault or fracture (assumed)
Air photo lineament
Foliation (inclined, vertical)
Fracture cleavage (inclined, vertical)
Gneissic foliation (inclined, vertical)
Igneous layering (inclined, vertical)
Vein or sheet veins (inclined, vertical)
Massive quartz
Area of extensive metasomatism, brecciation and quartz veining; locally mylonitized
Outcrop
D-4 Drill hole
Prospect (Mods Cards)
Bedrock mineral occurrence
Float: molybdenite bearing
Float: wolframite bearing
Float: molybdenite and wolframite bearing

Abbreviations

Be - Beryl
Bi - Bismuthinite
Cu - Chalcopyrite (possible bornite locally)
F - Fluorite
K - Kaolinite
Mo - Molybdenite
R - Anomalous radioactivity (>5 x background)
S - Scheelite
W - Wolframite (subscripts refer to scheelite)
Zn - Sphalerite

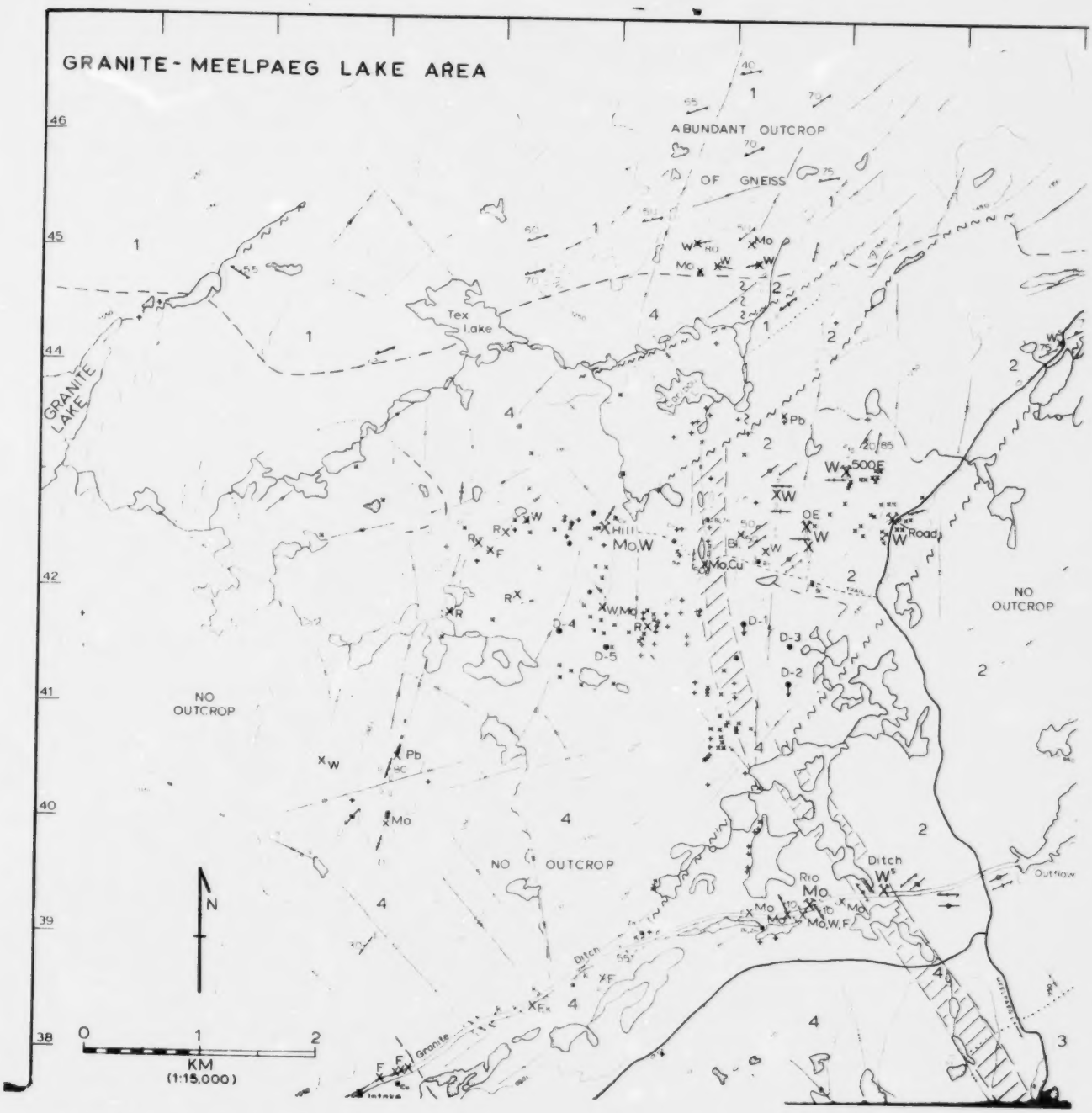

Figure 1. Geological and mineral occurrence compilation of the Granite Lake - Meelpaeg Lake area.

Geological investigations in the Port Blandford - Clarenville area, eastern Newfoundland (NTS: 2D/1, 2D/2, 2D/8)

by

Douglas Reusch and Cyril O'Driscoll
Mineral Deposits Section

Introduction

The project was mainly concerned with 1:50,000 scale mapping of a poorly known part of the Love Cove Group, dominantly schistose volcanic rocks, located within and adjacent to the proposed Bay du Nord wilderness area. Of special interest is the potential of these rocks for gold deposits. A second area, located near Tug Pond south of Clarenville, and reported to contain pyritic quartz-rich rocks near the margin of Swift Current Granite, was briefly examined.

Stratigraphy

The Love Cove Group (Unit 1) includes volcanic and related rocks of Precambrian age in the western Avalon Zone. Within the map area, southwest of Port Blandford, it is composed of predominantly felsic to intermediate pyroclastic rocks, specifically ash-flow tuffs, and lesser lavas and tuffaceous sedimentary rocks. In general, the group is difficult to subdivide. However, distinctive sequences of crystal tuffs (subunit 1a), red to white felsic tuffs and lavas (subunit 1b), bedded tuffaceous sedimentary rocks (subunit 1c), intermediate lavas and tuffs (subunit 1d) and several other less extensive units have locally been separated.

High-level granites and gabbros (Unit 2) are about twice as extensive as shown on previous maps of the area. They are thought to be comagmatic with the volcanic rocks. A narrow unit of quartz porphyry along the margin of one of the granite bodies is interpreted as a ring dike within a caldera system.

Four new occurrences of quartzite (Unit 3) were located in the central part of the map area. Conglomerate beds in the northernmost occurrence contain rare granite boulders, which suggest a nonconformable relationship with Units 1 and 2. The southwesternmost occurrence consists of white, cross-bedded orthoquartzite, interpreted as a shoreline facies, and it may correlate with the Random Formation.

Structure and Metamorphism

Bedding in the Love Cove Group can only be observed in a few places due to the massive, thick nature of its tuff beds. Moderately west-dipping upright beds and steeply dipping east-facing beds were noted. Units 1 to 3 have been metamorphosed to greenschist facies grade, and contain abundant sericite and chlorite. The schistose fabric dips steeply west-northwest to west-southwest.

The contact between the Love Cove Group and the less deformed, less metamorphosed Musgravetown Group (Unit 4) to the east is sinuous. It dips west at one place near the Trans Canada Highway. The northern segment may be a thrust, and an isolated occurrence of volcanic rocks west of Port Blandford may form a klippe.

Westward, the Dover Fault, a 100-m-wide mylonite zone, truncates granites of Unit 2 and juxtaposes greenschist facies rocks to the east

with gneisses and sheared retrograded K-feldspar-megacrystic granites of the Gander Zone to the west. The mylonitic foliation is assumed to overprint the regional schistosity of Units 1 to 3. Several small-scale structures suggest dextral movement on the fault.

Economic Geology

Several large white quartz veins and zones of very weak hydrothermal alteration (pyrite, sericite, chlorite) were located within the Love Cove Group. These zones do not contain any anomalous precious-metal values.

In the Tug Pond area, to the east of the map area, pyrite-quartz-rich rocks occur within the eastern margin of the Swift Current Granite. They appear to be quartzolites of magmatic rather than hydrothermal origin.

LEGEND

PALEOZOIC

7 Ackley Granite: massive, coarse grained granite; 7a, gabbro

6 Sheared, orange K-feldspar-megacrystic granite

5 Gneiss

PRECAMBRIAN

4 Musgravetown Group: red fluviatile sandstone and shale

3 White to gray quartzite, locally cross-bedded

2 Foliated, fine to medium grained granite; lesser quartz porphyry and gabbro

1 Love Cove Group: felsic to intermediate volcanic and related sedimentary rocks; 1a, feldspar-quartz-crystal tuff; 1b, red to white felsic tuffs and flows; 1c, thin to medium bedded tuffaceous sedimentary rocks; 1d, intermediate flows and tuffs

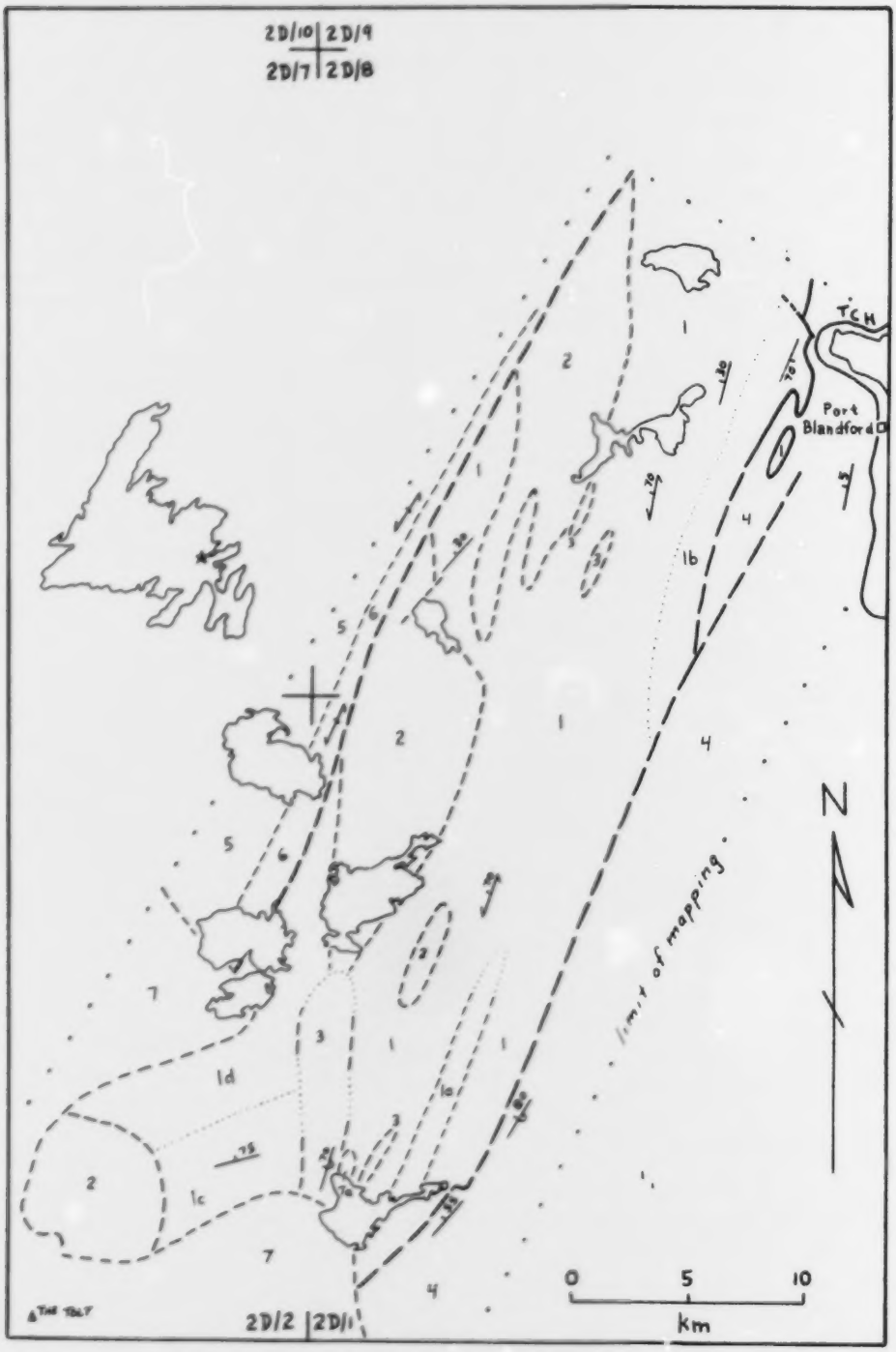

Figure 1. Geological map of the Love Cove Group southwest of Port Blandford, eastern Newfoundland

Metallogeny of peralkaline rocks in Labrador: Strange Lake Peralkaline Granite and Letitia Lake (Mann #1) showing

by

R.R. Miller
Mineral Deposits Section

Introduction

Work on the Strange Lake (Zr-Y-Nb-Be-REE) and Letitia Lake (Nb-Be) rare-metal-bearing peralkaline intrusives has been ongoing since the summer of 1984. Most of the field work on these intrusives and the related deposits was completed during the 1984 and 1985 field seasons. The Letitia Lake area was visited during the past field season in order to complete the mapping and sampling of the peralkaline intrusives in this region. The main thrust of this project, during the past year, has been toward preparation of maps, data analysis and laboratory studies.

The Mann #1 showing and related peralkaline rocks are located in central Labrador, 290 km east-southeast of Schefferville and 160 km northwest of Goose Bay (Figure 1). The Strange Lake deposit and its host peralkaline granite are located in northern Labrador (on the Quebec-Labrador border), 150 km west of the coastal village of Nain and 250 km northeast of Schefferville (Figure 1).

Figure 1. Location of the Letitia Lake and Strange Lake areas.

Strange Lake Peralkaline Granite

Thin section, chemical and computer studies of samples and data collected from the Strange Lake Complex are continuing. See Miller (1986) for an introduction to the geochemistry and petrography of the peralkaline granite and the associated mineralization.

Literature research is also continuing, with the objective of compiling a geochemical database of mineralized and unmineralized peralkaline granites. This database will be used to: 1) define a classification of mineralized/unmineralized peralkaline granites, 2) compare the Strange Lake and Letitia Lake mineralization to other granites, and 3)

determine geochemical exploration methods to distinguish the Strange Lake and Letitia Lake types of mineralization from other kinds of mineralization and from non-mineralized peralkaline complexes.

Letitia Lake Rare-Metal Showings

Several days were spent in the Letitia Lake area sampling and mapping some of the lesser known showings and sampling the nearby, apparently poorly mineralized, peralkaline granites. All planned field studies in this area have now been completed.

Geochemical and petrographic data from these samples will hopefully aid in distinguishing between barren peralkaline intrusives and mineralized intrusives. This study should lead to the establishment of a set of criteria that will help explorationists identify high-potential rare-metal-bearing granites.

Preliminary observation from the field work indicates that mineralized peralkaline intrusives in the Letitia Lake area occur at or near the contact with the younger Seal Lake Group (Miller, 1985). Petrographic studies indicate that the dominant peralkaline phase in the mineralized complexes is syenite, whereas the dominant phase in the unmineralized complexes is granite.

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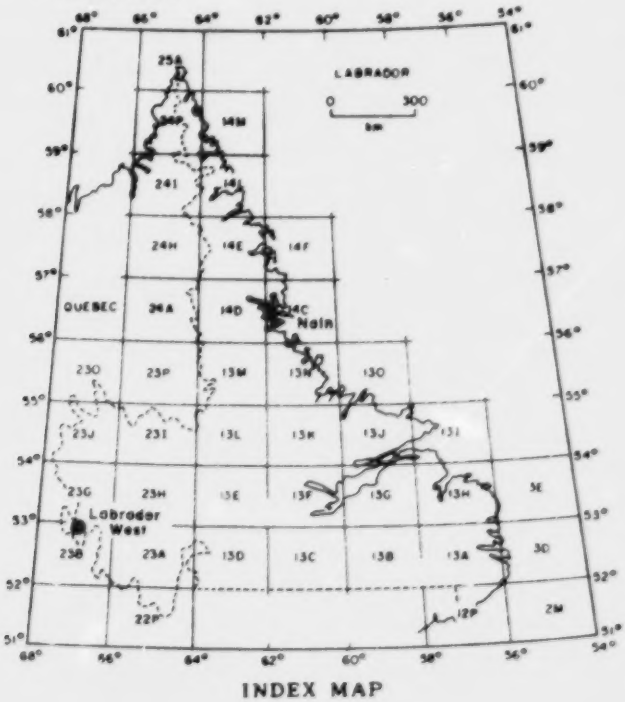
Industrial minerals in Labrador

by

J.R. Meyer and P.L. Dean
Mineral Deposits Section

Introduction

Two industrial-mineral programs were carried out in Labrador in the summer and fall of 1986. The first was an assessment of the dimension-stone potential of three prospects south of Nain, and the second was a silica-drilling program in western Labrador.



Dimension Stone Assessment

The three dimension-stone prospects south of Nain were briefly visited in 1985 and were thought to have sufficient potential to warrant more detailed evaluation (Meyer and Dean, 1986). The prospects occur within the Nain anorthosite complex, which is well known for its occurrences of coarsely crystalline, gem-quality labradorite (Watson, 1980). These three prospects, however, consist of massive, more homogeneous, medium to coarsely crystalline anorthosite, containing chatoyant labradorite crystals 0.5 to 4.0 cm across. They have much better potential for the quarrying of large uniform blocks suitable for the dimension-stone industry.

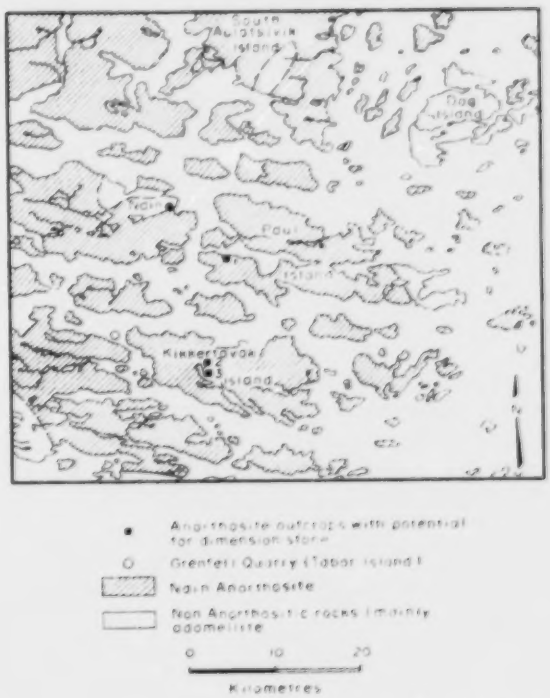


Figure 1: *Location map of dimension stone sites in the Nain anorthosite complex.*

The assessment of these prospects during the 1986 field season consisted of mapping out the fracture and vein systems, and the drilling and wedging out of anorthosite blocks, 30 to 50 cm on a side. These blocks were transported to Nain and shipped to St. John's. They will be slabbed and polished this fall for further evaluation.

The first prospect is at Ten Mile Bay (site 1, Figure 1) where a quarrying operation was previously attempted in the 1960's. The anorthosite at this locality is medium grained (0.5 to 1.5 cm), and the percentage of medium-blue, chatoyant labradorite crystals is consistently 10 to 15 percent, the greatest percentage of any anorthosite seen during the summer. Since the initial quarrying attempt, new techniques and equipment have evolved, and it would now be feasible to try starting a quarry operation at this site using a different approach. Several blocks from the original quarrying attempt remain on the beach at this prospect, and 5 smaller blocks were split off from these and brought back to St. John's.

The second prospect is 500 m due south, and 80 to 90 m in elevation above John Hays Harbour (site 2, Figure 1). It occurs in a 300-m-wide saddle-shaped pass between the harbour and Igiak Bay, and is relatively free of jointing and fracturing. The anorthosite is medium to coarsely crystalline (0.5 to 5.0 cm) and approximately 5 to 10 percent of the labradorite crystals are chatoyant and commonly color zoned. A deep blue-color dominates, usually forming the outer rim of the larger crystals, with a zonation of green, yellow, and bronze toward the centres. The coloration is extremely attractive and should be a positive factor in the appearance of the final polished material. Hyperstene comprises 3 to 10 percent of the rock and is interstitial to the labradorite crystals. The hyperstene crystals are 1 to 8 mm in size, anhedral to euhedral, and triangular cross-sections are common. The hyperstene crystals will probably polish well and appear shiny black on a finished surface. Ten sites were investigated at the John Hays Harbour prospect, and test blocks for slabbing and polishing were selected from four of these.

The third area is referred to as the Igiak Bay prospect. It is a huge, flat to gently dipping, glacially smoothed hilltop, 60 to 70 m above and to the east of the head of Igiak Bay. The roughly square-shaped area covers approximately 0.5 km^2, and is relatively free of jointing and fracturing. Twelve sites were investigated here and nine 40- to 90-kg test blocks were selected from five of these. The anorthosite is medium to coarsely crystalline and has a higher mafic content (5 to 15 percent) than the other two prospects. Labradorite crystals are 1.5 to 10 cm in size (3 cm average), blocky to rectangular shaped, and 5 to 8 percent are chatoyant, commonly color zoned, and rarely twinned. A light-blue color dominates but there are some green and minor yellow crystals. The other four sites have varying percentages of chatoyant labradorite crystals and mafic minerals, giving them quite different appearances and thus allowing for the possibility of several different types of dimension stone from this prospect.

Silica-Drilling Program

In 1984, an industrial-minerals survey in western Labrador was initiated in an attempt to strengthen and diversify the area's economic base, which is almost entirely dependent on the iron ore industry. As part of this survey, the white quartzite

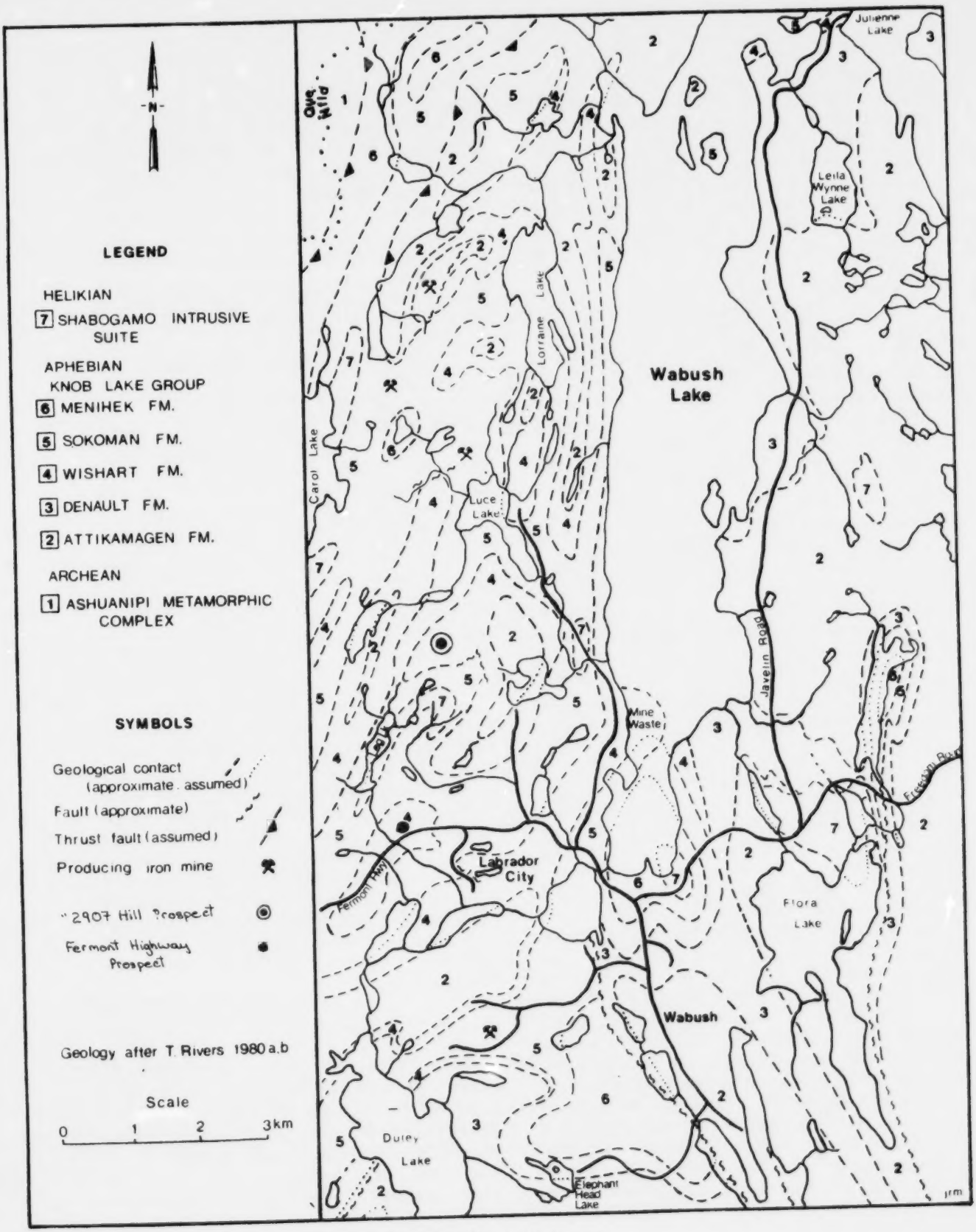


Figure 2: Geological map of Labrador City / Wabush area.

ridges immediately to the north and west of Labrador city were investigated as potential sources of high-quality silica. The best exposed ridges were chip sampled and described, and the results were published (Meyer and Dean, 1986). On the basis of these results, two large, high-grade silica prospects were selected for drilling. These two sites are the "2907 Hill" prospect, and the Fermont Highway prospect (Figure 2). A contract for this preliminary assessment work was awarded by CANMET through the Canada-Newfoundland Mineral Development Agreement to Golder Associates, who subcontracted the drilling to Longyear Canada Inc.

The 2907 Hill prospect is 5 km north of Labrador City and approximately 2 km from the nearest, easily passable dirt road. It is a well rounded hill, approximately 750 m in diameter, and has a minimum relief of 100 m. Five vertical holes were drilled in a "x-shaped" pattern in this propsect for a total of 272.8 m. The quartzite drill core is white to gray, commonly with red hematitic or yellow to orange limonitic staining. The quartzite is coarsely crystalline, consisting of 2- to 5-mm, tightly interlocking, subhedral quartz crystals. There is a small amount of intercrystalline, vitreous, gray specularite in 1- to 5-mm plates, and these commonly oxidize to orange-brown limonite. A small percentage of rounded to elongated vugs are present throughout much of the core and are typically filled with dark-brown to reddish-brown limonite. The core is moderately fractured and these fracture surfaces are usually coated with brown, orange, or yellow limonite, less commonly specularite, and rarely muscovite.

The first hole, which is at the centre of the x-pattern, was drilled to a depth of 120.4 m in an attempt to determine the thickness of the quartzite in this prospect. Light- to dark-green amphibolite, in bands 2 cm to 2 m thick, were intersected at 81.1 m, and are thought to represent sills related to a nearby body of the Shabogamo intrusive suite. Beyond this depth, the quartzite is banded with biotite-rich zones, and at 94.6 m this changes to alternating layers of white quartzite and quartz - biotite - garnet $\pm$ muscovite gneiss. There were no intersections of amphibolite or gneiss in the other four drillholes.

The moderate but persistent fracturing in 2907 Hill, and the limonite-filled vugs, which are found in small percentages throughout most of the core, indicate a high permeability and transport of iron by water. This may account for the very clean surface exposures and the deep weathering of the quartzite.

The Fermont Highway prospect is located on the north side of the highway, 3 km west of Labrador City. White, medium to coarsely crystalline, friable quartzite is well exposed on the floor and vertical walls of a 100-m-wide pit, where it was once quarried for road construction. The quartzite is extremely pure, and it is friable enough that it could be hydraulically mined. This prospect is on the side of a hill that slopes down toward the highway, and was drilled to investigate the extent and purity of this unique quartzite.

It was impossible to retrieve core from this prospect with a conventional diamond drill, and thus a percussion drill was used. A fines-collector system on the percussion drill made it possible to collect 5 to 15 kg of quartz sand for each 3.1-m interval drilled. Six holes, totalling 161.5 m, were drilled in a

"t-pattern" in this prospect, including a 9-m test hole in the floor of the pit. The deepest hole was 42.6 m, at a distance of 200 m northwest, and uphill from the road. There is one interval in each hole at approximately 20-m depth, where the color of the quartzite is light to medium gray, but otherwise all the samples are very white. There was no change in the pressure required for the drill to penetrate the "rock", thus it is assumed that there is no change in the friable nature of the quartzite to the depths drilled.

The quartzite drill core and sand samples from this drill program have been split and are presently being analyzed. Mineralogical and metallurgical studies are also underway; results will be available in 1987.

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REGIONAL GEOLOGY - LABRADOR

Regional mapping in the Traverspine-McKenzie River area (13F1-F2), Labrador (Goose Bay Project)

by

R.J. Wardle and L.V.J. Crisby
Labrador Mapping Section

The area mapped during the 1986 field season lies in the interior Grenville Province of southern Labrador, where it adjoins ground covered during previous work (Wardle and Ash, 1986) in the Goose Bay area. The map area consists predominantly of meta-igneous rocks that form a western continuation of an igneous suite in the Mealy Mountains area (see Emslie, 1976).

The oldest rocks preserved are small inclusions, too small to be shown on the geological map, of amphibolite gneiss, which contain fabrics that predate incorporation in the younger rocks. The major part of the area comprises granitoid plutons, which intrude and enclose a wide variety of metagabbroic rocks thought to represent the relicts of a once widespread mafic igneous suite. The size of these mafic enclaves varies from centimetres to kilometres, and only the larger ones are shown on the map. Of the granitoid intrusions,only two (the monzonite of unit 2 and alkali-feldspar granite of unit 7) are inclusion free.

The granitoid intrusions are dominantly of monzonite-granite composition, but range to monzodiorite, quartz monzonite, syenite and alkali-feldspar granite. Both pyroxene and hornblende-biotite-bearing varieties of these rocks are present.

The metagabbroic and granitoid igneous rocks are physically contiguous with granitoids of the Mealy Mountains intrusive suite, which has been dated at 1670-1650 Ma in sites about 100 km northeast of the map area.

Both the metagabbroid and granitoid rocks are intruded by a suite of diabase and gabbro dikes. Some dikes are slightly recrystallized and locally intruded by granitic material; the bulk, however, appear fresh and undeformed. Several of the fresh dikes also have cross-cutting contacts with tectonic fabrics in their host rocks. The age of the dikes is unknown: some may correlate with the Mealy dikes of circa 1380 Ma age (Park and Emslie, 1983); others, however, may be of late Proterozoic-Paleozoic age, and may be related to development of the Lake Melville graben.

Rocks of the Late Proterozoic-Paleozoic Double Mer Formation are inferred to extend into the western part of the map area, under the drift cover of the Churchill River valley.

The plutonic rocks of the map area were weakly to moderately deformed in an event presumed, but not proven, to have been the Grenvillian Orogeny. The severity of deformation increases in a general fashion from south to north,with the result that rocks north of, and immediately south of, the Churchill River are of gneissic and locally migmatitic aspect.

The Lake Melville lowlands are thought to form part of the Lake Melville graben, a Late Proterozoic-Paleozoic structure whose development may have been associated with dike intrusion and northeast-trending brittle faulting.

Pleistocene glaciation and subsequent ice retreat left a thick

LEGEND

PLEISTOCENE

Glacial, fluvioglacial and estuarine deposits

LATE PROTEROZOIC-PALEOZOIC

d — Diabase-gabbro dikes

9 — Area suspected to be underlain by Double Mer Formation sandstone and conglomerate

EARLY-MIDDLE PROTEROZOIC

d' — Metadiabase-gabbro dikes

8 — Pink, foliated granite to granite gneiss and amphibolite to amphibolite gneiss; both typically garnetiferous

MEALY MOUNTAINS INTRUSIVE SUITE

7 — Buff, alkali-feldspar granite

6 — Heterogeneous, pink granites containing metagabbro-amphibolite enclaves; minor gray granite, pyroxene granite and quartz monzonite

5 — Buff to pink, alkali-feldspar granite, granite and quartz syenite; includes enclaves of metagabbro-amphibolite

4 — Mixed unit comprising pink to gray, typically K-feldspar-porphyritic monzonite; pink granite-quartz monzonite, lesser alkali-feldspar granite; abundant metagabbro-amphibolite enclaves

4a — Purple-gray monzonite and brown monzodiorite, both typically K-feldspar porphyritic, and containing enclaves of metagabbro-amphibolite

3 — Buff to cream, pyroxene monzonite containing metagabbro-amphibolite enclaves

2 — Buff to cream, pyroxene monzonite, typically containing relict, ovoid plagioclase phenocrysts; minor alkali-feldspar granite

1 — Unit consisting predominantly of metagabbro, ranging in composition from melagabbro to leucogabbro, and their amphibolite equivalents; includes lesser amounts of intrusive pink granite, quartz monzonite and monzonite

Amphibolite and amphibolite gneiss seen only as small inclusions in younger rocks (too small to be shown on map)

Striated till - drumlinoid ridges

Southern limit of partial melt textures in granitoid rocks

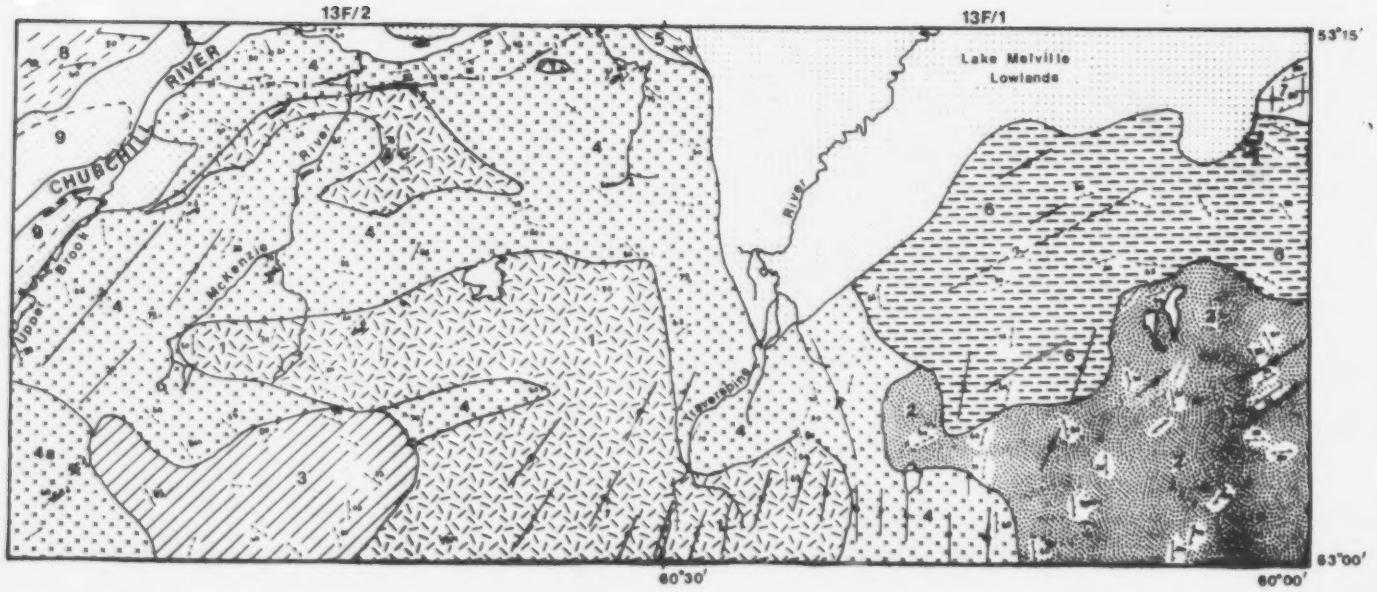

Figure 1. Geology of the Traverspine - McKenzie River area, Labrador.

mantle of striated till in the southern part of the area, and thick outwash sand deposits in the Churchill River valley. The Lake Melville lowlands are underlain by a stratified sequence of sand, gray clay and pebbly sand of probable estuarine-lacustrine origin.

Mineralization in the map area is limited to very small occurrences of pyrite and pyrrhotite in plutonic rocks.

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Geology of the Port Hope Simpson 1:100,000 Map Area

by

Charles F. Gower, Sigrid Neuland, Mark Newman and John Smyth
Labrador Mapping Section

The Port Hope Simpson map area (13A/9, 10, 15, 16, 3D/12, 13) is located in southeastern Labrador and encompasses an area of approximately 4500 km2.

The region can be subdivided into four southeast-trending geological sectors. These are, from northeast to southwest, (i) Paradise metasedimentary gneiss belt, (ii) White Bear Arm complex, (iii) a broad zone of mylonitized rock types extending from Gilbert Bay to south of Alexis Bay, and (iv) metasedimentary gneisses in the southwest part of the area.

The Paradise metasedimentary gneiss belt, a continuation of similar rocks mapped for 120 km to the northeast, consists of uniform cordierite-bearing (pseudomorphed to sillimanite + magnetite + biotite) pelitic gneiss with some muscovite-rich areas and amphibolite. It is intruded by K-feldspar-megacrystic and non-megacrystic granitoid rocks, which are locally associated with orthopyroxene-bearing, migmatitic diorite envelopes.

The White Bear Arm complex, which continues about 90 km to the northwest, comprises fine to coarse grained gabbronorite, troctolite, monzonite, syenite and K-feldspar-megacrystic variants of the granitoid types. Double orthopyroxene-amphibolite coronas mantling olivine are ubiquitous. In many areas, primary rock types have been extensively amphibolitized.

The region south of the White Bear Arm complex, extending to Alexis Bay,is underlain by interfingering, variably deformed, K-feldspar-megacrystic granitoid rocks and sillimanite-biotite pelitic gneiss with minor calc- silicate rock and quartzite. Granitic gneiss in this zone was derived from either a metasedimentary gneissic or granitoid protolith. These rocks are flanked to the south, in turn, by the Alexis River anorthosite and dioritic to amphibolitic gneiss. The Alexis River anorthosite is a distinctive unit of recrystallized anorthosite, leucogabbronorite and minor ultramafite. The dioritic gneisses and amphibolitic gneisses are interpreted as transposedequivalents of the same layered basic intrusion.

The southwest corner of the map area is underlain by sillimanite-bearing pelitic gneiss intruded by K-feldspar-megacrystic granitoid rocks.

All the above units were involved in the Grenvillian Orogeny. Postdating this event are, (i) small granite plutons at Gilbert Bay and in the southwest part of the area, (ii) the Gilbert conglomerate (probably similar in age to the Double Mer Formation), and (iii) north-northeast-trending, late Precambrian-early Paleozoic mafic dikes.

The structure of the region is dominated by a central zone of right-lateral strike-slip faults and associated mylonites. Additional strike-slip faults bound the White Bear Arm complex and separate rock types within it. Tight northwest-trending folds are defined in several areas.

LEGEND

LATE PRECAMBRIAN - EARLY PHANEROZOIC

GABBRO, DIABASE DIKES

GILBERT CONGLOMERATE (SINGLE LOCALITY)

LATE MIDDLE PROTEROZOIC - (POST-GRENVILLIAN)

GRANITE; COARSE GRAINED, MASSIVE

MIDDLE PROTEROZOIC - (PRE-GRENVILLIAN)

UNASSIGNED MAFIC PLUTONIC ROCKS

GRANITOID PUTONS

K-FELDSPAR MEGACRYSTIC GRANITOID ROCKS AND DEFORMED DERIVATIVES

GRANODIORITE TO QUARTZ DIORITE

QUARTZ DIORITE, ORTHOPYROXENE-BEARING IN PART

ALEXIS RIVER ANORTHOSITE

ANORTHOSITE, LEUCOGABBRONORITE AND METAMORPHIC DERIVATIVES

MIDDLE PROTEROZOIC - (PRE-GRENVILLIAN) (continued)

WHITE BEAR ARM COMPLEX

MONZONITE, QUARTZ SYENITE, GRANITE

GABBRONORITE, GABBRO, TROCTOLITE AND METAMORPHIC DERIVATIVES

METASEDIMENTARY GNEISS

PELITIC AND PSAMMITIC METASEDIMENTARY GNEISS, MINOR AMPHIBOLITE AND CALC-SILICATE ROCK

QUARTZITE

ORTHOGNEISS

BIOTITE GRANITE GNEISS

BIOTITE AND HORNBLENDE GRANODIORITE - QUARTZ DIORITE GNEISS

DIORITE AND AMPHIBOLITE GNEISS

SYMBOLS

GEOLOGICAL BOUNDARY

NORMAL FAULT

STRIKE SLIP AND THRUST FAULTS

ANTIFORM

SYNFORM

GNEISSOSITY, FOLIATION 40

0 4 8 12 16

KILOMETRES

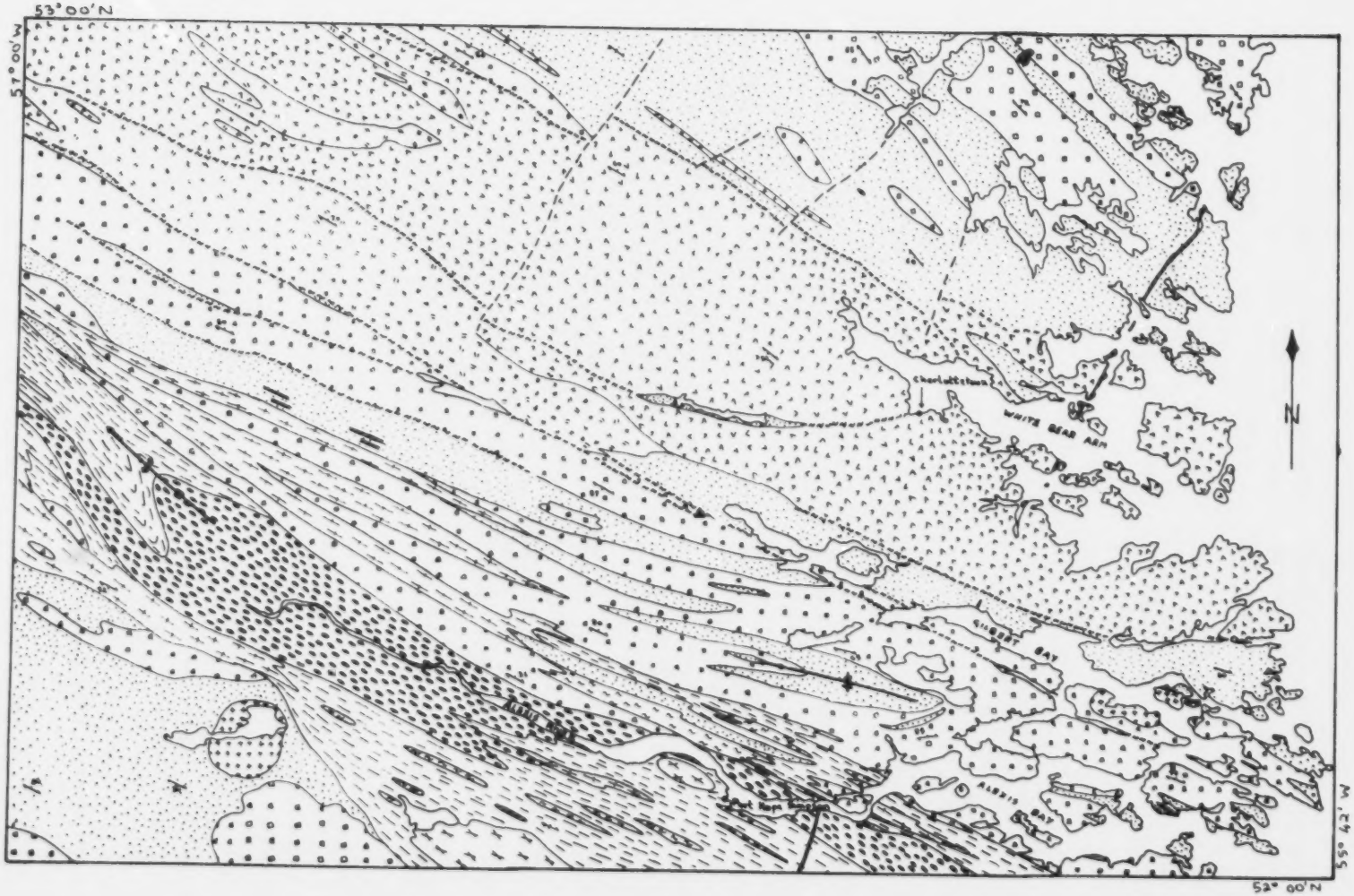

Figure 1. Geology of the Port Hope Simpson map area.

The best prospects for economic mineralization are in the metasedimentary gneisses, which host numerous pyritic showings, locally containing traces of copper mineralization. Muscovite-bearing pegmatites are found throughout the metasedimentary gneiss. Blocks (1 m across) and *in situ* lenses (50 cm across) of an opaque mineral, probably ilmenite, were found associated with the Alexis River anorthosite. No anomalous radioactivity was detected anywhere in the region.

Geochemistry and mineral potential of granitoid rocks in the eastern Central Mineral Belt, Labrador

by

Andrew Kerr
Labrador Mapping Section

Introduction

This project was initiated in 1985 to assess the mineral potential of granitoid rocks in east-central Labrador, and also to investigate the anatomy and petrogenesis of the Trans-Labrador batholith, a major middle Proterozoic magmatic belt transecting central Labrador. Previous field work (Kerr, 1986) consisted of a lithogeochemical sampling program covering about 5000 km2 of the batholith. Field work during 1986 included the extension of the regional sampling program to cover the Benedict Mountains area, and also more detailed follow-up mapping and sampling in areas that appear to be underlain by highly differentiated and/or enriched granitoid rocks.

The geology of the study area, including the major subdivisions of the granitoid rocks, has been described elsewhere (Gower et al., 1982; Kerr, 1986), and is not discussed here.

Regional Lithogeochemical Sampling Program

Lithogeochemical sampling in areas underlain by granitoid rocks is intended to provide a broad overview of geochemical characteristics, and also assist in the mapping of major intrusive units. The 1986 sampling program was concentrated to the east of the 1985 project area, and resulted in coverage of a further 2000 km2 of the Trans-Labrador batholith through the well-exposed terrain of the Benedict Mountains. Approximately 400 samples were collected at an average site spacing of 2 km.

The main focus of economic interest in this area appears to be the Tukialik Bay granite, a coarse grained, feldspar-megacrystic, biotite granite containing ubiquitous accessory and vein-style fluorite. However, several other units are also locally fluorite bearing. There is also a noticeable textural and grain-size variation associated with differences in elevation, and the highest peaks are commonly composed of fine grained material that has a subvolcanic appearance, suggesting proximity to the upper surface of the batholith. Volcanic rock types exposed in one particularly rugged area appear generally undeformed and may be part of an extrusive carapace above the batholith.

Follow-up Mapping and Sampling

Geochemical data from the 1985 regional sampling program did not become available until spring 1986, and is still not fully complete. Available data was subjected to a preliminary assessment prior to the field season in order to identify those areas where geochemical signatures and petrographic data suggest the presence of differentiated and/or enriched rocks that might have potential for granophile mineralization.

The locations of areas in which follow-up work was undertaken during the 1986 field season are shown in Figure 1. Some of the more important areas are briefly discussed below.

LEGEND

EARLY TO MIDDLE PROTEROZOIC

Grenville Province gneisses

26 Strongly deformed granitoid rocks (probably equivalent to the Trans-Labrador batholith).

Trans-Labrador batholith c. 1650 Ma

Smaller granitoid bodies

25 Medium grained, equigranular, alkali-feldspar granite.

24 Assorted granite, alkali-feldspar granite and quartz syenite.

23 *Dog Islands granite:* fluorite-bearing biotite granite similar to Strawberry granite (included in Benedict Mountains intrusive suite by Gower, 1981).

22 *Strawberry granite:* variably textured, porphyritic, biotite granite containing accessory fluorite.

21 Fine grained quartz monzonite to granite.

20 *Monkey Hill granite:* gray to pink, fine grained adamellite.

Benedict Mountains / Nipishish Lake intrusive suites

19 K-feldspar porphyritic granodiorite.

18 *Otter Lake-Walker Lake granite:* gray to pink, K-feldspar porphyritic, biotite-hornblende quartz monzonite to granite.

17 Pink equigranular alkali-feldspar leucogranite.

16 Pink to white biotite-hornblende granite and leucogranite.

15 Pink K-feldspar porphyritic granite to alkali-feldspar granite displaying 'pseudo-rapakivi' texture.

14 Gray to brown porphyritic granodiorite to adamellite.

Adlavik intrusive suite

13 Brown to gray K-feldspar porphyritic syenite.

12 Pink to white quartz monzonite.

11 Plagioclase porphyritic monzonite.

10 Diorite and monzodiorite.

9 Gabbro and leucogabbro.

EARLY PROTEROZOIC

Makkovikian granitoid rocks c. 1850 Ma

8 Gray leucocratic granodiorite.

7 Foliated granodiorite, diorite and quartz monzonite.

6 Pink, foliated, K-feldspar porphyritic granite and equigranular leucogranite.

5 Foliated biotite-hornblende quartz monzonite to granite, local fluorite-bearing leucogranite.

4 *Long Island quartz monzonite:* variably foliated melanocratic quartz monzonite.

Supracrustal rocks

3 **Upper Aillik Group:** felsic volcanic and volcaniclastic rocks, subvolcanic intrusive rocks, minor metasedimentary rocks and mafic volcanic rocks.

2 **Lower Aillik Group:** mafic metavolcanic rocks and assorted metasedimentary rocks.

ARCHEAN

1 Quartzofeldspathic orthogneisses, amphibolites, metasedimentary rocks and metamorphosed granitoid rocks (includes gneisses reactivated during early Proterozoic events).

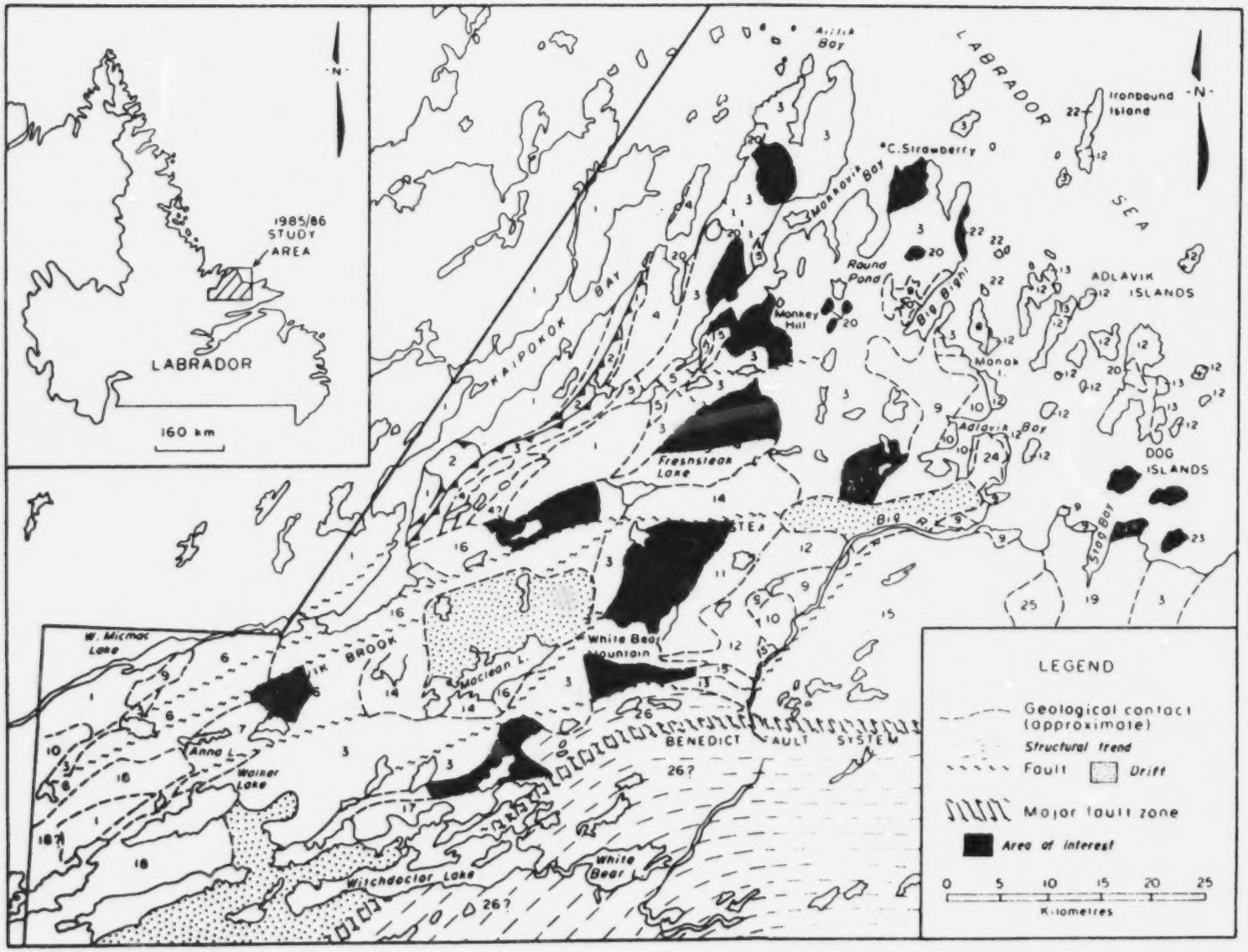

Figure 1. Geological map of the study area showing areas discussed in the text (partly after Gower et al., 1982).

Strawberry and October Harbour granites

These two bodies northeast of Makkovik are fluorite-bearing, feldspar-megacrystic, biotite granites that show evidence of a fairly high level of emplacement and the presence of a fluid phase. The Strawberry granite was mapped in detail at 1:25,000 scale and sampled along with adjacent country rocks. Much of the body is homogeneous and, although textural variations are evident, it has not proved possible to define separate subunits through most of the body. Fine grained, miarolitic, and fluorite-bearing phases are common around the edges of the body, but usually form only a narrow zone. The contacts with the Aillik Group are sharp on a scale of 5 to 50 m in most coastal exposures and appear to be fairly steep in attitude. However, this does not appear to be true of the southern contact in inland areas, which is a more complex zone where roof pendants of Aillik Group are present and fine grained granites more abundant. Tuffisite breccias also have been recognized in this area. It is suggested that this contact is shallow in attitude. South of, and vertically above this contact, Aillik Group metavolcanic rocks are variably altered and bleached (nature of alteration is as yet uncertain), and contain numerous gossan zones. Some of these are molybdenite bearing and have a stockwork-like form suggestive of epigenetic hydrothermal mineralization related to the underlying granite (D. Wilton, personal communication, 1986).

Dog Islands Granite

This is a fluorite-bearing, feldspar-megacrystic, biotite granite similar to the Strawberry granite, but generally more homogeneous. It was examined very briefly this year in a few localities where it appears to be anomalous in several trace elements. In one of these localities, Cu-Pb mineralization was discovered in association with fine grained aplitic material, suggesting that a more thorough examination of the body is warranted.

Bayhead granite

This informal name is applied to a regionally extensive, feldspar-megacrystic, biotite granite southeast of Kaipokok Bay, which is also similar to the Strawberry granite. Areas anomalous in a variety of trace elements (principally Zr, Rb, La, Th and Nb) were mapped and sampled on a spacing of approximately 1 km. Mapping has confirmed the lithological correlation with Strawberry, but did not reveal any significant mineralization.

Pistol Lake granite

This small granite body southwest of Adlavik Bay is anomalous in Zr, Nb, Ga, Th and La, and has a major-element chemistry that borders on alkaline (agpaitic index close to 1.0). It is a quartz-poor granitoid, which is locally syenitic, and in some respects it resembles syenitic rocks associated with the Adlavik intrusive suite. No mineralization is known from the body, but its northern contact is close to several U showings, one of which (the 7-11 showing) also contains significant Ag. It has been sampled in more detail, with particular emphasis on the northern edge and adjacent country rocks.

Tarun Lake-White Bear Mountain area

This is one of the largest anomalous areas recognized from 1985 regional data. It is underlain mostly by syenite, quartz syenite and granite, which resemble some of the

rock types in the Pistol Lake body. These rocks are alsospatially associated with intermediate rocks typical of the Adlavik intrusive suite. The geochemical signature is also very similar to that at Pistol Lake, and the rocks seem to have alkaline tendencies. Ground traversing has confirmed lithological similarities between the two areas, but has not shown the presence of significant mineralization.

Kennedy Mountains area

This area south of Makkovik Bay is underlain by foliated recrystallized granitoids that are presumed to be part of the c.1850 Ma old Makkovikian suite. They are commonly fluorite-bearing biotite granites and leucogranites that are locally anomalous in Zr, La, Nb, U and Th. Ground work in this area has demonstrated the existence of two or three discrete phases, but their contact relations are unknown. A fine grained phase in the northern part of the body hosts several zones of pyritization along its contact with the Aillik Group, but no other mineralization is present.

Other areas

In addition to the main areas discussed above, several other granitoid bodies or portions of bodies shown in Figure 1 were examined and sampled in more detail. No new mineralization was discovered in these areas.

Work Planned for Next Year

Analysis and interpretation of regional data from the 1985 field season is still incomplete, and much of the winter will be spent collating this information. Samples collected during the 1986 regional sampling in the Benedict Mountains will be accorded the highest priority for chemical analysis, so as to complete the regional database and allow follow-up work to be planned. The 1987 field season will be aimed at follow-up work in areas defined by 1986 data, and also at geological field work designed to clarify field relationships between different components of the Trans-Labrador batholith.

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Geology of the Churchill Province and Elsonian intrusions, in north-central Labrador (NTS 14D/2, 6, 7)

by

Bruce Ryan, Louise Corriveau and Dan Lee
Labrador Mapping Section

In the second year of this project, mapping in the Nain-Strange Lake corridor has progressed westward from the coast, with its predominance of mid- Proterozoic igneous intrusions, into the Churchill Province of the Labrador plateau, where post-Hudsonian intrusions are subordinate to high-grade metamorphic rocks.

The 1986 project area (Figure 1) is dominated by gneisses that exhibit a broad range of compositions and structural style. Conspicuous among the gneisses are metasedimentary supracrustal rocks, including garnet-sillimanite gneisses, clinopyroxene-bearing psammite, and quartzite and marble; the garnet- sillimanite paragneiss commonly has associated with it a white, garnetiferous, granite gneiss believed to be a diatexite. A mylonitic variant of this latter gneiss underlies a 35-km-wide zone east of the 1986 project area, the westernmost extent of which occurs at the southern margin of the rapakivi granite. Mafic gneisses, considered to be derived from both supracrustal rocks, and homogeneous to layered gabbroic intrusions, are also a widespread component of the Churchill Province in this area. These vary from finely laminated to massive units, including narrow screens of metasedimentary rocks to mesoscopically layered rocks, which in some cases have clear intrusive relationships with adjacent units. Curiously, the majority of metasedimentary and metabasic rocks are confined to an eastern area of gneisses that exhibit granulite facies metamorphic assemblages. The surrounding rocks are quartzofeldspathic granulites of plutonic origin, many of which can be demonstrated to be intrusive into both the metasedimentary rocks and some of the mafic gneisses.

West of the granulite terrane lies a broad zone of amphibolite facies granitic gneisses (demonstrably retrogressed granulite facies rocks in many cases) of chiefly metaplutonic origin, containing zones from less than 1 m to several kilometres wide of pink, equigranular to porphyritic, foliated granite of probable late kinematic age. Field relationships and map pattern indicate that some of these granitic gneisses are intrusive into a gray, migmatitic,amphibolite facies, granodioritic gneiss, as well as mafic and metasedimentary gneisses. Mylonitic fabrics locally characterize all amphibolite facies rocks from this central zone.

The western part of the area is characterized by granulite facies gneisses, and a lobe of pink, amphibolite facies rocks at the southwest corner.

The Churchill gneisses are intruded by three posttectonic plutons, all of which are western extensions of those mapped to the east in 1985. The northern mass is a homogeneous, coarse grained, rapakivi granite; it has imposed a 1-km-wide contact-metamorphic aureole on the adjacent rocks. South of this is a chocolate-brown-weathering olivine gabbro, and south of Cabot Lake is a hypidiomorphic biotite granite, which may be temporally related to the rapakivi pluton.

Two "Skyvan" airborne radiometric anomalies were detected along Anaktalik Brook by the Geological Survey of Canada in 1982. The source of one of these is white garnetiferous granite sheets, which intrude rusty pelitic gneisses and are interpreted as synmetamorphic intrusions; the sheets contain abundant, minute, disseminated crystals of an orange-brown, vitreous mineral believed to be allanite. The source of the second anomaly could not be pinpointed. Rusty, sulfide-rich zones characterize many of the metasedimentary and mafic gneisses. Several of the most extensive of these pyrite-pyrrhotite zones were sampled for assay.

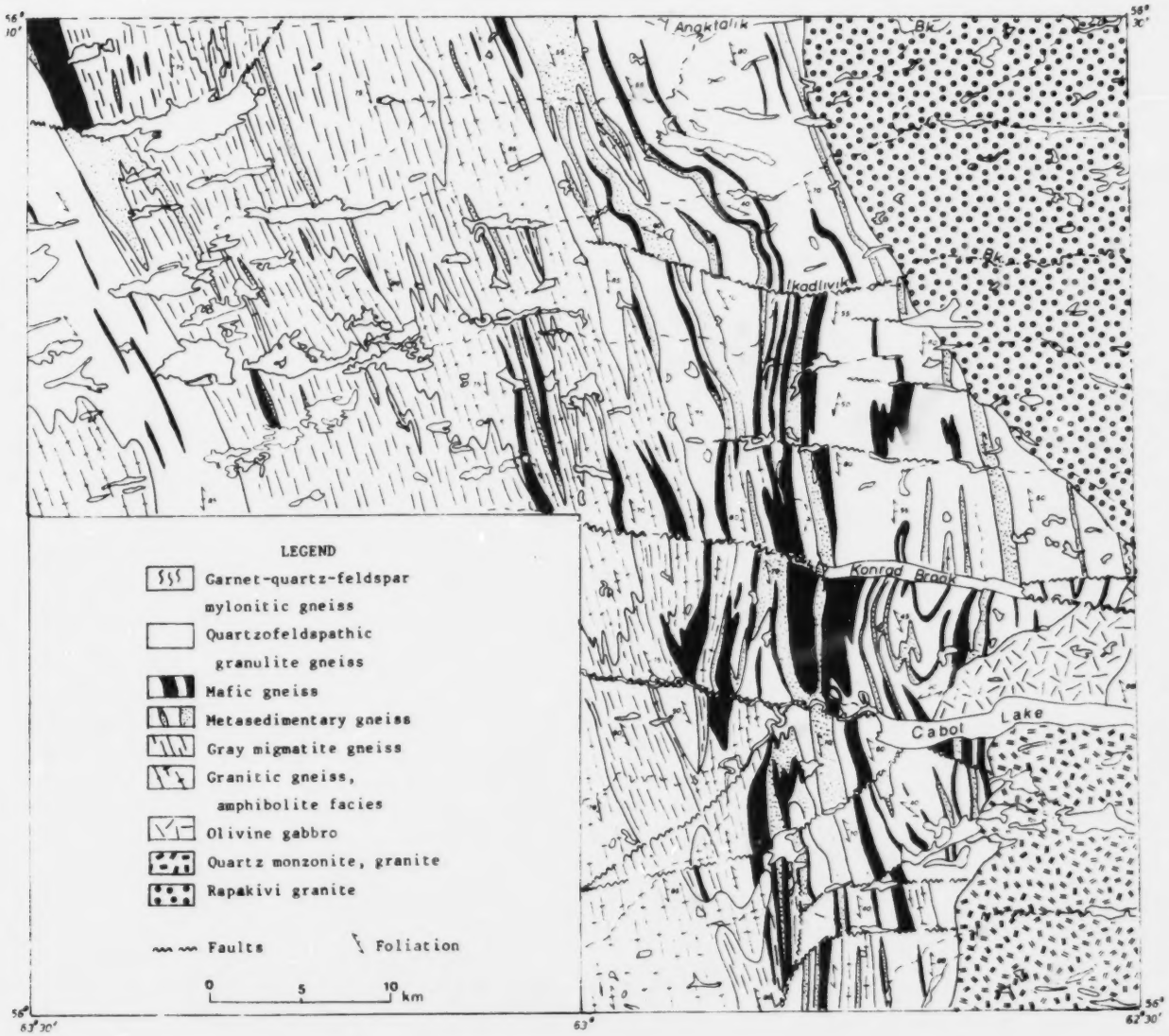


Figure 1. Sketch map outlining the major geological components of the Cabot Lake - Anaktalik Brook area, north-central Labrador.

Gold Reconnaissance in the Archean Ashuanipi Complex of western Labrador

by

A. Thomas
Labrador Mapping Section

No major mineral exploration programs have been carried out on Superior Province Archean rocks belonging to the Ashuanipi Complex in western Labrador. This fact, together with the discovery by the Ministère de l'Energie et des Resources du Québec of significant Au mineralization 70 km northwest of Schefferville, Quebec, and the recent release by the Geological Survey of Canada of regional lake sediment geochemical data for the Ashuanipi rocks were the impetus for the present study. Approximately 80 percent of the Ashuanipi Complex was given a cursory examination using a combination of helicopter and ground traversing. The approach used was to define target areas (ranked 1 to 7 on Figure 1) that contained one or more lake sediment geochemical and/or aeromagnetic anomalies.

One hundred and seventeen samples of both mineralized bedrock and boulders were collected, the localities of which are indicated by small numbers on Figure 1. These were submitted for analyses of the elements Au, Ag, Bi, Mo, Zn, Cu, Co, Cd, Hg, Sb and As. To date, results are available for only Au, which yielded bedrock values ranging from a low of less than 1 ppb to a high of 426 ppb. The highest values found in float were 160 ppb, which occurred in a boulder of mafic rock mineralized with stringer chalcopyrite and disseminated to stringer pyrite, pyrrhotite, molybdenite and arsenopyrite(?), and 759 ppb, which occurred in an angular, frost-heaved boulder of mafic gneiss.

Figure 1. Target areas and sample localities for the gold reconnaissance study of the Ashuanipi Complex.

Regional geology of southwestern Lac Joseph (23A), southeastern Lac Opocopa (23B) and northwestern Lac Fournier (22P) map area, southwestern Labrador

by

J.N. Connelly and P. Scowen[1]
Labrador Mapping Section

Introduction

The map area is covered by 1:50,000 scale NTS map sheets 23A/3, 4, 5 and 6 and those parts of NTS map sheets 23B/1, 8 and 22P/14 within Labrador. The area covered by NTS map sheet 23A was previously mapped by Stevenson (1968). Jackson (1976) mapped the area covered by NTS sheets 23B/1 and 8.

General Geology

The area is divided, on the basis of rock types and physiography, into two terrains: 1) the low-lying, poorly exposed western terrain, which comprises a suite of acid and basic plutonic rocks, and 2) the more complex, better exposed eastern terrain, underlain by pelitic and mafic supracrustal rocks intruded by suites of basic and acid plutonic rocks (Figure 1). Poor exposure along the length of the tentative boundary between these terrains has hampered attempts to accurately define its nature and location.

Western Terrain

The granitiod rocks in the western terrain range in composition from granite to granodiorite and are commonly medium grained, foliated and equigranular. Although gneissic banding is not observed, recrystallization has occurred to varying degrees.

The basic intrusive rocks typically contain plagioclase, clinopyroxene and oxides, are medium grained and commonly moderately foliated. Deeply weathered gabbroic rocks, exhibiting plagioclase - garnet rims around clinopyroxene cores, have been correlated with the Shabogamo intrusive suite mapped in areas to the north by Rivers (1985). Due to poor exposure, the lithologic boundaries within the western terrain are only approximately located and relationships between the granitoids and basic rocks are unknown.

Eastern Terrain

The eastern terrain is predominantly underlain by pelitic to semipelitic paragneiss, which has been divided into three main map units: 1) sillimanite- bearing paragneiss, 2) muscovite-bearing paragneiss, and 3) sillimanite- and muscovite-bearing paragneiss.

The sillimanite-bearing paragneiss contains at least one phase of fine to medium grained migmatitic melt (K-feldspar - plagioclase - quartz) interlayered with sillimanite - biotite - magnetite ± garnet-bearing restite to define a strong gneissosity. Locally a late, medium grained migmatitic phase cross-cuts the earliest gneissosity but is itself deformed. It is unknown if this late phase of melting is a continuation of the early phase or a separate episode.

[1] Department of Geological Sciences, Queen's University, Kingston, Ontario, K7L 3N6

The strongly banded muscovite-bearing paragneiss typically comprises restite layers containing randomly oriented muscovite, quartz and biotite, and white leucosome layers containing plagioclase and quartz ± muscovite.

The pelitic paragneiss, which contains both sillimanite and muscovite, appears similar to the sillimanite-bearing paragneiss, but has abundant, randomly oriented muscovite within the leucosome and, more rarely, muscovite coexisting with sillimanite in the restite.

The pelitic paragneiss is interlayered with minor amounts of mafic paragneiss composed primarily of plagioclase and clinopyroxene ± orthopyroxene ± hornblende, and cross-cutting leucosomes of plagioclase ± orthopyroxene.

The supracrustal rocks were intruded by a suite of basic plutonic rocks ranging in composition from norite to gabbro. These composite plutonic bodies typically exhibit well preserved igneous textures and poorly developed tectonic fabrics, and are medium to coarse grained. In addition to the dominant mineral phases (plagioclase - clinopyroxene ± orthopyroxene ± oxides), olivine rarely forms cores to a plagioclase - clinopyroxene symplectic rim.

A composite granitoid batholith within the eastern terrain typically comprises medium grained, equigranular granite to granodiorite and coeval megacrystic (K-feldspar) granite. The granitic pluton in the northern part of the eastern terrain exhibits poorly developed rapakivi texture.

Late, undeformed diabase dikes preferentially intrude the supracrustal rocks.

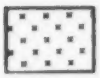
Structure and Metamorphism

Metamorphic conditions must have culminated during the earliest deformation period (D_1), resulting in extensive partial melting of the supracrustal rocks and the pervasive sillimanite - biotite - magnetite ± garnet assemblage within the pelitic paragneiss. The earliest planar fabrics include a strong gneissic banding, aligned biotite, matted sillimanite and flattened quartz grains. Coeval linear fabrics include sillimanite aligned on the S_1 surface and elongated quartz grains. Within the mafic paragneiss, fabrics apparently coeval with those in the pelitic paragneiss are defined by aligned pyroxene and/or hornblende.

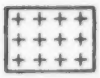
These early fabrics were subsequently folded into tight to isoclinal folds with variably plunging fold axes, commonly parallel to the sillimanite/ quartz lineation. The rarity of F_2 axial planar fabrics and the preservation of intricate crenulations of the S_1 mineral fabric suggest that lower temperatures prevailed during the refolding event, prohibiting further widespread mineral recrystallization in the paragneiss. The time interval between the two deformation events is unknown but it is possible that they are continuous, or represent two separate, regionally significant periods of deformation.

The assemblages within the muscovite-bearing paragneiss are thought to be the products of static retrogression of the sillimanite-bearing paragneiss. This is supported by the random orientation of the muscovite and biotite, the compositional and structural similarities, and the spatial association of the two units. The apparent spatial relationship between large areas of muscovite-bearing paragneiss and

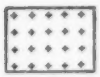
LEGEND



Equigranular granite and granodiorite with minor megacrystic granite

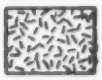


Rapakivi-textured granite; k-feldspar-megacrystic granite and equigranular granite to granodiorite

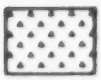


K-feldspar-megacrystic granite and equigranular granite

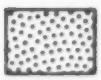
Shabogamo intrusive suite: deeply weathered, foliated, garnet-bearing gabbro; foliated gabbro



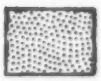
Massive to weakly foliated gabbro, gabbronorite and norite



Mafic paragneiss interlayered with pelitic paragneiss



Pelitic paragneiss; sillimanite-bearing restite and muscovite-bearing leucosome



Pelitic paragneiss; muscovite bearing

Pelitic paragneiss; sillimanite bearing with minor layers of psammitic paragneiss

/ S_1 fabric orientation: dips approximately vertical

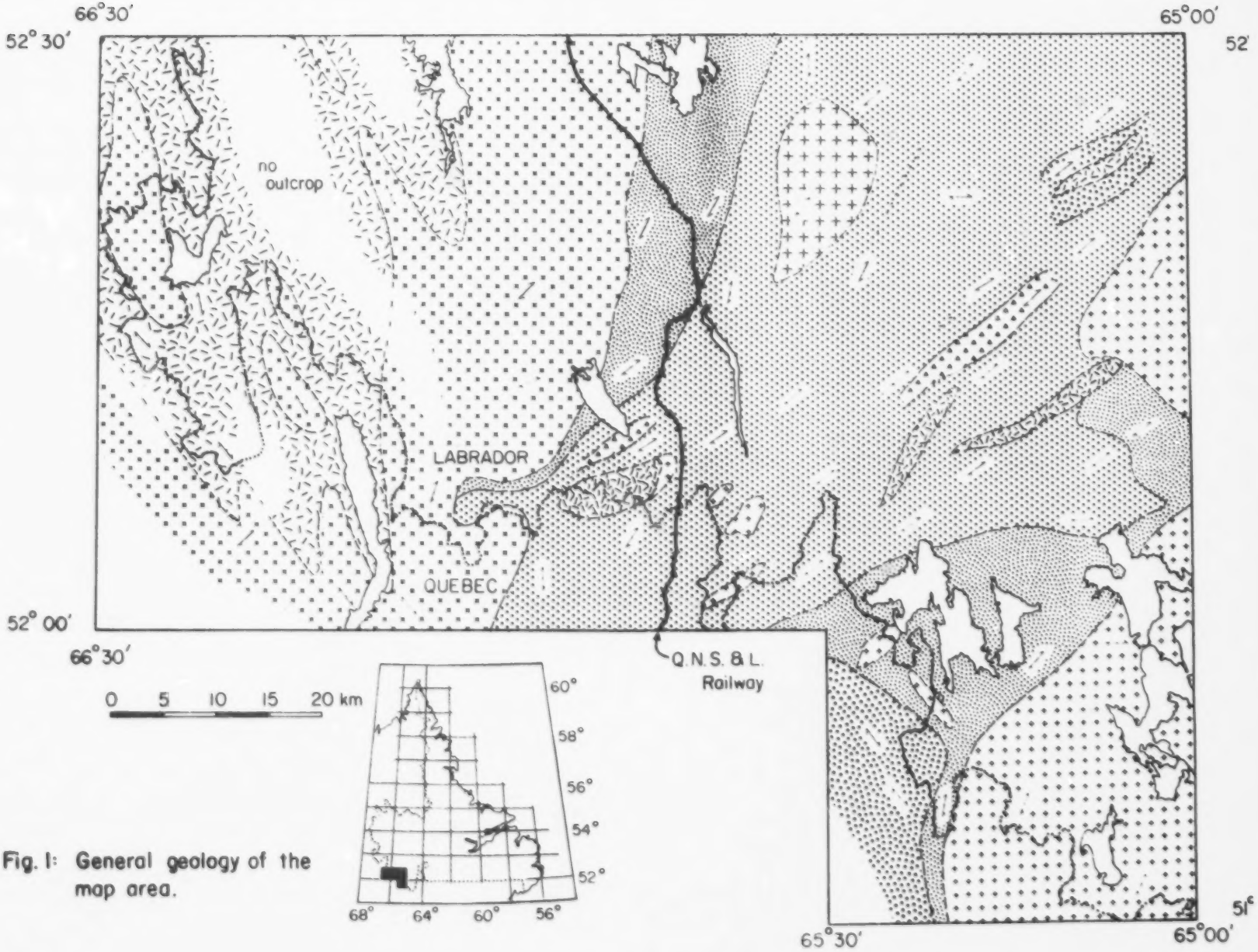


Fig. 1: General geology of the map area.

granitoid bodies suggests the retrogression may have occurred during the intrusive event.

The low-strain state and lack of partial melting within the plutonic rocks in the eastern terrain, together with the commonly observed relationship of granitoid dikes cross-cutting the strong gneissic banding in the supracrustal rocks, suggest these plutons were emplaced after the D_1 event. Fabrics and recrystallization within the plutonic rocks may be attributed to the D_2 refolding event.

Variably developed planar and linear fabrics within the plutonic rocks in the western terrain are defined by flattened and/or elongated mineral grains and aligned biotite and muscovite. Gneissic banding is absent.

The contrast in fabric orientation between the western and eastern terrains (see Figure 1) and the lack of paragneiss in the western terrain inhibit correlation of structural fabrics across the tentative terrain boundary.

Economic Geology

Mineralization is limited to local occurrences of disseminated pyrite within the pelitic paragneiss. A mineralized zone approximately one metre wide and containing up to 50 percent pyrite was found within the pelitic paragneiss, parallel to the gneissosity. Although this zone persists along the length of the outcrop, it was not traced to surrounding outcrops.

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REGIONAL GEOLOGY - NEWFOUNDLAND

Summary of the geology of the Mount Sylvester (2D/3) map area

by

W. Lawson Dickson
Newfoundland Mapping Section

The survey of the area north and east of the Ackley Granite (see Dickson, 1983) has resulted in the most detailed map to date with some significant changes in the distribution of rock types, and changes in the boundaries of units compared to that shown by Swinden and Dickson (1981; see map 1).

The sedimentary units from part of the Middle Ordovician Baie D'Espoir Group. A major break in the stratigraphy occurs where a series of ultramafic rocks (Unit 1) separate the scheelite-bearing psammite and semipelite of the North Steady Pond Formation (Units 20 and 21) from black pelite and psammite of the St. Joseph's Cove Formation (Unit 16). The ultramafics form the southwestward continuation of a series of serpentinized ultramafics located to the east of Middle Ridge (Blackwood, 1983). These ultramafics must define a major fault (possibly a thrust) between the Dunnage and Gander zones. This alignment also coincides with ultramafics and shearing in the Salmon River Dam and D'Espoir Lake areas to the west of St. Albans.

To the south of the ultramafics, the next major unit is the St. Joseph's Cove Formation, which contains the Twillick Brook Member (Unit 18), an areally extensive tuff that is bound on both sides by poorly exposed graphitic andsilicified pelite. The areal extent of the tuff unit increases to the northeast where it is over 4 km wide compared to the normal 1.5-km width. Several varieties of tuff are present; the dominant type is coarse grained quartz-feldspar-porphyritic tuff. A possibly significant feature of the tuff is the presence of patches of massive gossan, within generally fresh tuff. These gossans, near the northern boundary of the map, are newly recorded, although some were previously sampled. These gossans were analysed for gold and will be analysed for other elements (Table 1).

To the south of the tuff, the geology is much more complicated, and a possible facies change or disconformity occurs along strike. To the north of another series of acid volcanic rocks (Isle Galet Formation, Unit 10), gray pelite (Unit 14), graphitic pelite (Unit 16) and minor quartzite (Unit 17) grade laterally into micaceous sandstone (Unit 12) and interbedded quartzite, pelite and coarse grained sandstone (Unit 11), and conglomerate. These coarse grained clastic units also occur to the south of the acid volcanic rocks. The possibility exists that both coarse grained units are part of the same formation, and coalesce to the northeast in a northeast-plunging anticline with a core of acid volcanic rocks.

The acid volcanic rocks (Unit 10) are the main focus of gold exploration in this area and host the Kim Lake #2 antimony showing, which is reported to contain significant gold values. The volcanic rocks consist of massive rhyolite, lapilli tuff and crystal tuff, including fine grained tuff. Theyare locally highly altered with replacement of feldspars by iron oxides and sericitization of the matrix. These rocks terminate at the Kim Lake #2 trenches, east of Bay du Nord River, where they are

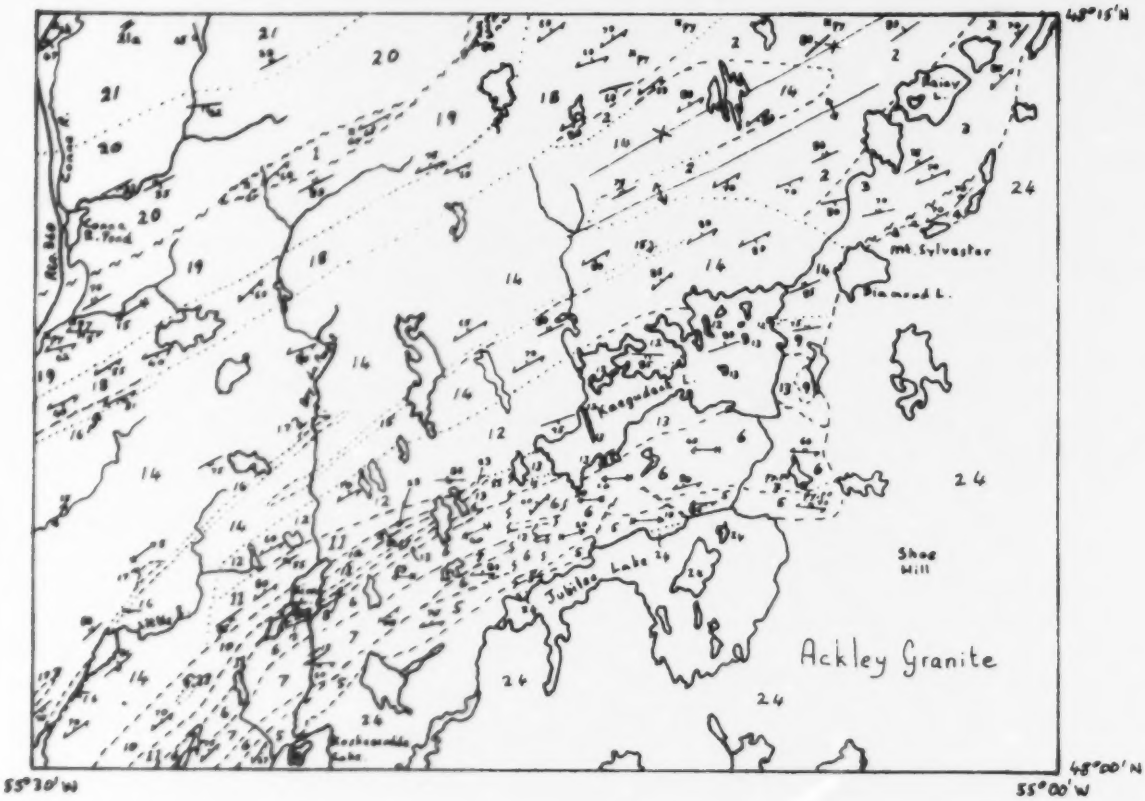

Figure 1. Geology of the Mount Sylvester (2D/3) map area, southeastern Newfoundland.

probably intruded by highly altered, coarse grained granite (Unit 23), which forms a 5-km-long dike. Samples were collected from the various altered volcanic rocks and the granite, and were analysed for gold and will be analysed for other elements (Table 1).

Along strike, to the northeast, the coarse grained clastics and micaceous sandstone overlie pelite (Unit 14). This pelite apparently has an unconformable contact with quartzite and gray psammite (Units 2, 3). These units are considered to be part of the Gander Group (Blackwood, 1983), although Swinden and Dickson (1980) assigned these rocks to the Baie D'Espoir Group. However, if the contact between the psammite and quartzite (Units 2 and 3) is transitional with the pelite (Unit 14), then they form part of the Middle Ordovician Baie D'Espoir Group - if they are in fault contact, then their assignment to the older Gander Group is possible; an unconformable contact would place the psammite in the Gander Group. This final possibility is based on the abrupt change along strike from quartz sandstone to pelite. An unfortunate gap in exposure and no significant anomaly in the aeromagnetic pattern prevent a conclusion at this time.

The southernmost stratified units are pillow lava and mafic tuff (Unit 7), with dominantly interbedded gray pelite, semipelite and acid tuff (all Unit 6) and psammite (Unit 5).

LEGEND

DEVONIAN

24 Ackley Granite: massive, pink to buff, coarse grained, K-feldspar-porphyritic, biotite ± hornblende granite and granodiorite; locally cut by medium grained, biotite-muscovite granite dikes

ORDOVICIAN(?)

23 Kim Lake Granite: altered, brecciated and quartz-veined, pink, leucocratic granite containing secondary muscovite; stibnite occurs locally along joints

22 Gray to green, weakly foliated, feldspar-porphyritic biotite-hornblende(?) granodiorite

MIDDLE ORDOVICIAN AND YOUNGER(?)

BAIE D'ESPOIR GROUP (Units 5-12, 14-21)

North Steady Pond Formation (Units 20 and 21)

21 Gray, medium bedded, contact-metamorphosed(?), biotite-muscovite psammite and semipelite; locally highly altered, containing scheelite mineralization; 21a, metadiorite dike

20 Gray to buff, thin bedded sandstone and minor siltstone

St. Joseph's Cove Formation and Riches Island Formation (Units 16-19)

19 Thin bedded, pyritic, black slate and minor, thin, interbedded, coarse grained sandstone and minor quartz-rich sandstone, and siliceous, graphitic(?) siltstone

18 Twillick Brook Member: very thick bedded, strongly cleaved, coarse grained, quartz-feldspar-crystal tuff and quartz-crystal tuff containing minor, interbedded, coarse grained sandstone and siltstone; locally highly altered to gossan

17 Thin to medium bedded, locally cross-bedded quartzite containing thin pelite interbeds

16 Thin bedded, black with white patches, graphitic pelite and siltstone

15 Thin, well bedded, black, siliceous siltstone

14 Gray to buff, medium bedded slate, siltstone and sandstone; pebble conglomerate occurs near contact with Gander Group (Unit 2)

13 Kaegudeck diabase: green to gray, generally massive, medium to fine grained, mainly equigranular to locally plagioclase-porphyritic, chloritized diabase sills and dikes

Isle Galet Formation (Units 5-12)

12 Thick to medium bedded, gray to buff, cleaved, locally cross-bedded and graded, micaceous, locally calcareous sandstone and minor interbedded gray slate

11 Thin to thick, interbedded quartzite, poorly sorted granule to pebble conglomerate and pelite

10 Thick massive rhyolite and lesser lapilli tuff, fine grained waterlain tuff, probable quartz-feldspar-crystal, ash-flow tuff; locally highly altered and cut by quartz veins, some containing pyrite or stibnite

9 Thin to medium bedded, gray sandstone hornfels and minor thin bedded pelite

8 Medium bedded red sandstone and minor red siltstone; locally displays cream-colored alteration

7 Unbedded, green to gray, chlorite schist (possibly fine grained mafic tuff), interbedded with deformed basaltic pillow lava; cut by thick dikes of Unit 13

6 Thin bedded, buff to cream, sericite schist and minor chlorite schist, and cleaved psammite interbedded with units of rhyolitic quartz-feldspar-crystal tuff; cut by thick dikes of Unit 13

5 Medium to thick bedded, gray sandstone and minor interbedded pelite; contact metamorphosed to cordierite schist along the contact with the Ackley Granite (Unit 24)

PRE-MIDDLE ORDOVICIAN

GANDER GROUP (Units 2, 3 and 4)

4 Thick bedded, strongly cleaved, cordierite-bearing pelite hornfels

3 Medium to thick bedded, cleaved, gray sandstone containing minor thin bedded pelite

2 Medium to thick bedded, cleaved, white-weathering, buff quartzitic sandstone containing thin pelite interbeds

ORDOVICIAN OR OLDER

1 Cleaved and sheared, serpentinized peridotite and dunite; contains disseminated chromite and local talc layers

Table 1. Gold values from chip samples in the Mount Sylvester (2D/3) map area

Sample No.	Grid Ref.	Rock Type	Gold p.p.b
		Kim Lake area	
2242806	221221	quartz-carbonate veins	ND*
2807	222235	rusty basalt	11
2808	224½246	rusty basalt	ND
2810	203227	rhyolite	ND
2811	192215	rhyolite + quartz	200
2812	176202	bitite-hornblende granodiorite	ND
2813	221207	Kim Lake 1 quartz	3
2814	221204	diabase	ND
2816	246261½	Kim Lake 2; rhyolite-west	6
2817	246261½	Kim Lake 2; rhyolite-west	29
2818	246262	Kim Lake 2; rhyolite-centre	8
2820	247262	Kim Lake 2; rhyolite-centre	82
2821	248262	Kim Lake 2; rhyolite-east	34
2822	248262	Kim Lake 2; granite-east	1
		Kaegudeck Lake area	
2823	307½282	quartz-carbonate veins	ND
2824	276277	altered granite	ND
2825	284½281	quartzite	ND
2826	389283½	rusty pelite	ND
2827	390284	rusty pelite	2
2828	375311	diabase + sulfide	ND
2830	374313	diabase	ND
2831	397½281½	pyrite-pyrrhotite vein	26
		Conne River and Bay du Nord River north area	
2800	125304	altered tuff	ND
2801	139311	altered tuff	ND
2802	116½441	rusty gray sandstone	39
2803	193388	peridotite	ND
2804	148448	hornblende diorite	ND
2805	200432½	quartz vein, pelite	ND
2832	333439	tuff gossan	ND
2833	348451	tuff gossan	ND
2834	403452	quartzite gossan	9

* ND - not detected

This succession is highly deformed and second-generation folds are common. These folds verge to the north and northwest and plunge gently, mainly to the west.

The effects of regional metamorphism are quite apparent in this succession, unlike those to the north. Extensive chlorite development occurs in this formation, and, to the south, contact metamorphism of the sedimentary rocks to cordierite and biotite hornfels occurs within 1 km of the Ackley Granite (Unit 24).

Mafic intrusives (Unit 13) of various sizes occur between Bay du Nord River and eastern Kaegudeck Lake. These have intruded the sedimentary rocks and locally cordierite has developed. Some mafic dikes have a well developed cleavage indicating that they could be related to the well cleaved mafic tuff and pillow lava (Unit 7). Previously reported layering in rocks interpreted as mafic intrusives (Swinden and Dickson, 1981) is reinterpreted here as thin beds (2 to 10 cm) in contact metamorphosed psammite (Unit 9), which may be in the pyroxene-hornfels facies.

Several mineralized veins and gossans occur within Unit 6 pelite; these are reported by Colman-Sadd and Swinden (1982) to contain pyrite and pyrrhotite ± galena ± sphalerite. These were sampled and analysed for gold and will be analysed for other elements (Table 1).

The contact of the Ackley Granite with the sedimentary units is exposed in several places. The contact is generally discordant to the main foliation or bedding, and large dikes (1 to 4 m wide) occur within the metasedimentary rocks. Cordierite development is extensive in the pelite. The granite is mainly massive, medium to coarse grained, and contains K-feldspar phenocrysts and biotite. Thin muscovite-bearing granite dikes cut the regular granite.

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Northwest Avalon Zone: west half of the Eastport (2C/12) map area

by

S.J. O'Brien
Newfoundland Mapping Section

A two-year geological study of the northwestern Avalon Zone (2C/12, 2C/13) was initiated by the Mineral Development Division in 1986. 1:50,000 scale mapping, coupled with more detailed sedimentological studies (by I. Knight), was carried out mainly in the west half of the Eastport (2C/12) map area (Figure 1).

The area is underlain by Late Proterozoic rocks that are disposed in three north-northeast-trending belts. The Love Cove Group is bounded in the west by the Musgravetown Group and in the east by the Connecting Point Group. The base of the Love Cove Group is not exposed in the map area. The group consists of variably deformed, in places isoclinally folded and highly strained, greenschist facies volcanic flows and pyroclastic rocks of mafic to felsic composition. A fault, marked by either a wide zone of shearing and brecciation or a knife-edged discordance, juxtaposes the Love Cove Group with the lowermost stratigraphic levels of the Connecting Point Group. The latter group has been subdivided into 1) a structurally overturned basal unit (2200 m thick) of gray sandstone, black shale, tuff and conglomerate, 2) an intermediate unit of folded, dominantly black shaley rocks (less than 1000 m thick), and 3) an upper, gently west-dipping unit (less than 2500 m thick) of gray and green sandstone and siltstone. The Connecting Point Group is overlain with angular discordance by red conglomerate of the Musgravetown Group, south of the map area at Bread Cove, Clode Sound (Hayes, 1948). In the Bread Cove Hills region, 3 km north of that unconformity (Figure 1), a northwest-trending succession of Musgravetown Group, consisting of red boulder conglomerate overlain by rhyolite and red sandstone, truncates the regional strike of the Love Cove and Connecting Point groups. At Northeast Arm (Figure 1), a major shear zone separates the Love Cove Group to the east from openly folded red and yellow-green cross-bedded sandstone and rhyolite of the Musgravetown Group. East of the shear zone, on the eastern limb of a faulted, north-plunging syncline, a 2-m-wide exposure gap separates a gently west-dipping sequence of relatively unmetamorphosed Musgravetown Group sandstone, rhyolite and basalt from schistose, isoclinally folded Love Cove Group rocks. Basal Musgravetown Group sandstone, adjacent to the Love Cove Group, contains no tectonic fabric and is neither fractured, brecciated nor veined. This contact may represent an angular unconformable relationship between the Love Cove and Musgravetown groups (cf. Jenness, 1963).

Small bodies of pretectonic granite and quartz diorite intrude the Musgravetown and Love Cove groups. In the vicinity of the Louil Hills, gabbro, diorite, riebeckite granite and hybrid rocks intrude the Love Cove Group. The structural contrast between these rocks and the Love Cove Group suggests they were intruded posttectonically with respect to the main deformation of the group. The Love Cove and Connecting Point groups are intruded by pretectonic and posttectonic diabase dikes.

LEGEND

DEVONIAN(?)

14 Diabase

LATE PRECAMBRIAN

13 Riebeckite granite, aplite

12 Gabbro, diorite and diabase; minor quartz diorite and granodiorite; plagioclase porphyry

11 Hornblende-biotite granite

MUSGRAVETOWN GROUP (no stratigraphic order implied)

10 Red, green and buff, cross-bedded sandstone

9 Vesicular basalt

8 Flow-banded rhyolite and ash-flow tuff

7 Red sandstone

6 Red cobble and boulder conglomerate

CONNECTING POINT GROUP

5 Gray and green sandstone containing minor pebble conglomerate; 5a, black shale and siltstone

4 Black shale containing thin sandstone beds and laminations; 4a, granule and pebble conglomerate interbedded with quartzose sandstone

3 Siliceous waterlain tuff and related pyroclastic rocks, black shale, gray sandstone and shale; conglomerate

LOVE COVE GROUP

2 Basaltic pillow lava and hyaloclastite; massive mafic tuff

1 Unseparated felsic, intermediate and mafic flows and pyroclastic rocks; quartz-epidote-sericite schist

×PY Pyrite showing

TNNP Boundary of Terra Nova National Park

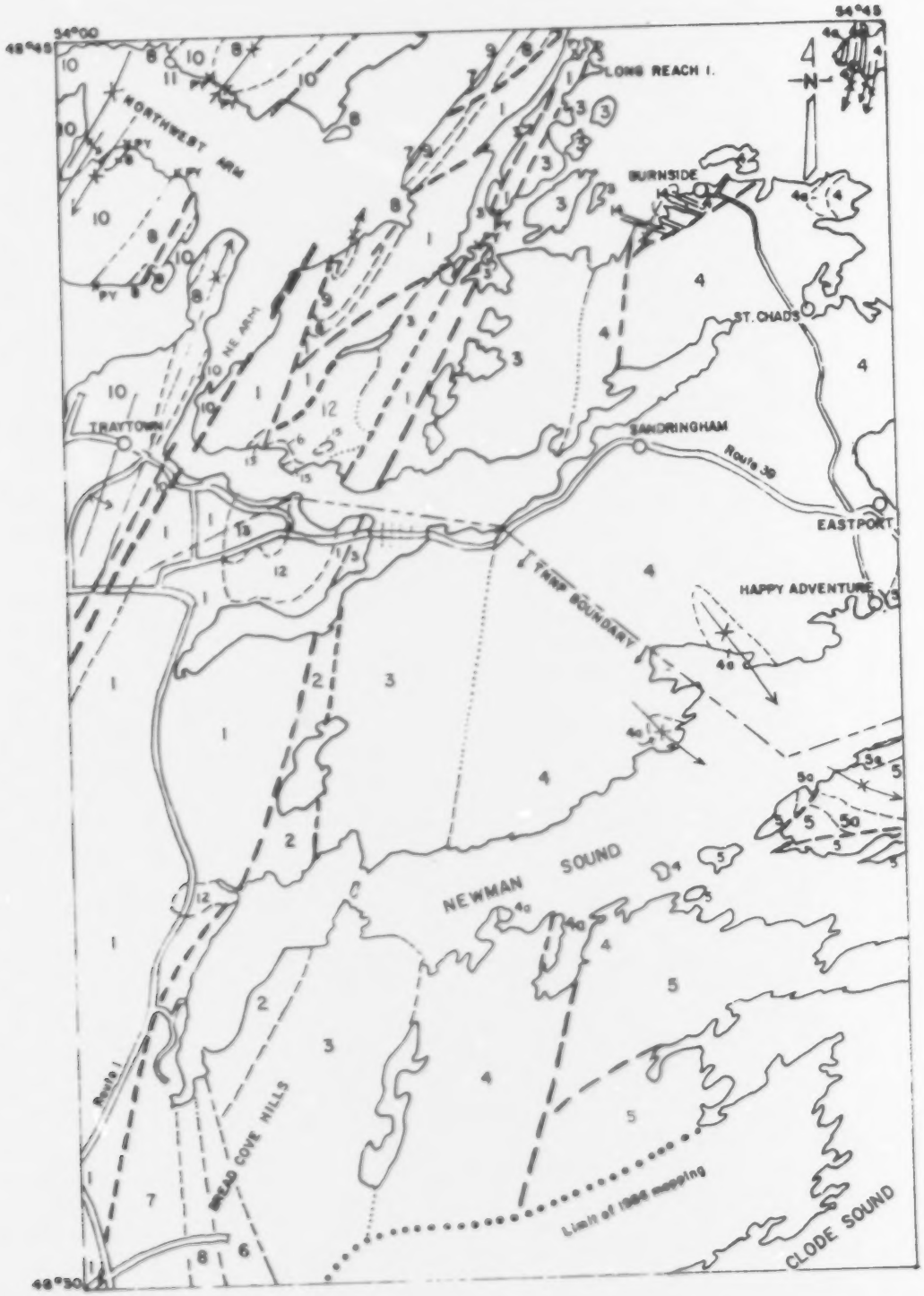

Figure 1. Geology of the west half of the Eastport (2C/12) map area.

A significant zone of silicification and pyritization was discovered in Love Cove Group felsic tuffs (previously mapped as Connecting Point Group) onLong Reach Island, approximately 5 km west of Burnside. The zone can be traced, sporadically, for approximately 5 km. At the south end of the island (and on the adjacent mainland), areas of silicification and sericitization occur together with very fine and coarse grained pyrite, chert and dark gray quartz veins in a 100-m-wide zone. The host is fine grained felsic lithic tuff, quartz-bearing lithic tuff-breccia and fine grained breccia, cut by mafic dikes. It may be significant that the alteration at Long Reach Island lies along strike from the arsenic-silver-gold (trace) showing on Inner Gooseberry Island (Murray, 1869) in the north, and from the Hickey's Pond area (Huard and O'Driscoll, 1986) in the south. The alteration zone at Long Reach Island, like that at Hickey's Pond, occurs at the eastern margin of the Love Cove Group.

Several zones of silicification and pyritization were also discovered in felsic volcanic rocks and rhyolite dikes of the Musgravetown Group near Northwest Arm. The location of these showings is given on Figure 1; all are worthy of further investigation.

Finally, the riebeckite granite at Louil Hills has significant potential for Zr-Nb-U-F mineralization.

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Geology of Snowshoe Pond (12A/7) Area, Newfoundland

by

Stephen Colman-Sadd
Newfoundland Mapping Section

The central and northwestern parts of the Snowshoe Pond area were mapped at a scale of 1:50,000 during 1986.

The area is divided into two parts by Noel Paul's line, which runs southeast of Lake Douglas and south of Rodeross Lake:

1. Clastic metasedimentary rocks, provisionally equated with the Early to Middle Ordovician Spruce Brook Formation, occur in the south and southeast. They are intruded by several generations of granite and granodiorite.

2. Volcanic rocks and associated sedimentary rocks and intrusions, typical of the Newfoundland Central Volcanic Belt, occur in the northwest. They are overlain or faulted against the Rogerson Lake Conglomerate, which may be Silurian.

The clastic metasedimentary rocks of Unit 1 consist of interbedded quartzite, psammite and semipelite. Just southeast of Lake Douglas they are metamorphosed in the greenschist facies, but throughout the rest of their outcrop area they are either at sillimanite grade or partially melted. They are intruded pretectonically by mafic dikes and granite of Unit 8, and posttectonically by granodiorite of Unit 10 and pegmatite of Unit 12.

The granite of Unit 8 has a pervasive tectonic fabric, which is locally mylonitic, particularly at Snowshoe Pond. Unit 9 migmatite, which appears to be derived at least in part from metasedimentary rocks of Unit 1, is gradational with granodiorite of Unit 10. Unit 10 is part of the North Bay Granite, and is largely undeformed. Pegmatite of Unit 12 is posttectonic and probably related to the North Bay Granite.

Noel Paul's Line, which marks the southeastern edge of the Central Volcanic Belt, has been relocated to the northeast of the highly deformed, greenschist facies rocks assigned to Unit 1. The sequence between Noel Paul's Line and Lake Douglas (Unit 2) consists of conglomerate, sandstone and shale interbedded with felsic crystal tuff, and includes possible felsic subvolcanic intrusions. The sequence strikes obliquely into the southeast shore of Lake Douglas and is probably separated by a fault from mafic volcanic rocks of Unit 3 on the northwest shore of the lake. Units 1, 2 and 3, together with limestone (which has not been found elsewhere), all meet in a zone of high strain, exposed on Noel Paul's Brook south of Lake Douglas. This high-strain zone marks the change in regional strike from northeast to east-west.

Unit 4 consists of unseparated fine grained clastic sedimentary rocks, and mafic and felsic volcanic rocks. It is bordered to the north, probably along a fault or an unconformity, by the Silurian(?) Rogerson Lake Conglomerate (Unit 7), which in turn is bounded by mafic dikes and volcanic rocks, and minor granitoid intrusions, of the Tally Pond volcanics (Unit 5).

LEGEND

SILURO-DEVONIAN

13 White leucogranite

12 Garnet-tourmaline-muscovite granite

11 Hornblende-biotite gabbro or diorite, and minor unseparated ultramafic rock

10 Porphyritic or equigranular, gray or pink, biotite granodiorite of the North Bay Granite; locally contains muscovite and locally has a fabric

9 Migmatite, rich in biotite schlieren and metasedimentary fragments

8 Equigranular to megacrystic, foliated, gray or pink, biotite granite; locally mylonitic

SILURIAN?

7 Rogerson Lake Conglomerate: purple, clast-supported, polymictic conglomerate and sandstone

ORDOVICIAN

6 Victoria Lake Group: unseparated sedimentary and minor mafic volcanic rocks

5 Tally Pond volcanics (Victoria Lake Group)
- 5a Mafic volcanic rocks
- 5b Mafic dikes and sills
- 5c Felsic intrusive rocks
- 5d Unseparated mafic volcanic rocks, dikes and sills, and breccia, conglomerate, sandstone and shale

4 Fine grained clastic sedimentary rocks, and minor mafic and felsic volcanic rocks

3 Mafic volcanic rocks, including pillow lava

2 Gray, felsic, crystal tuff and felsic intrusive(?) rocks, interlayered with shale, sandstone and conglomerate

1 Gray quartzite, psammite and schist (probably equivalent to Spruce Brook Formation)

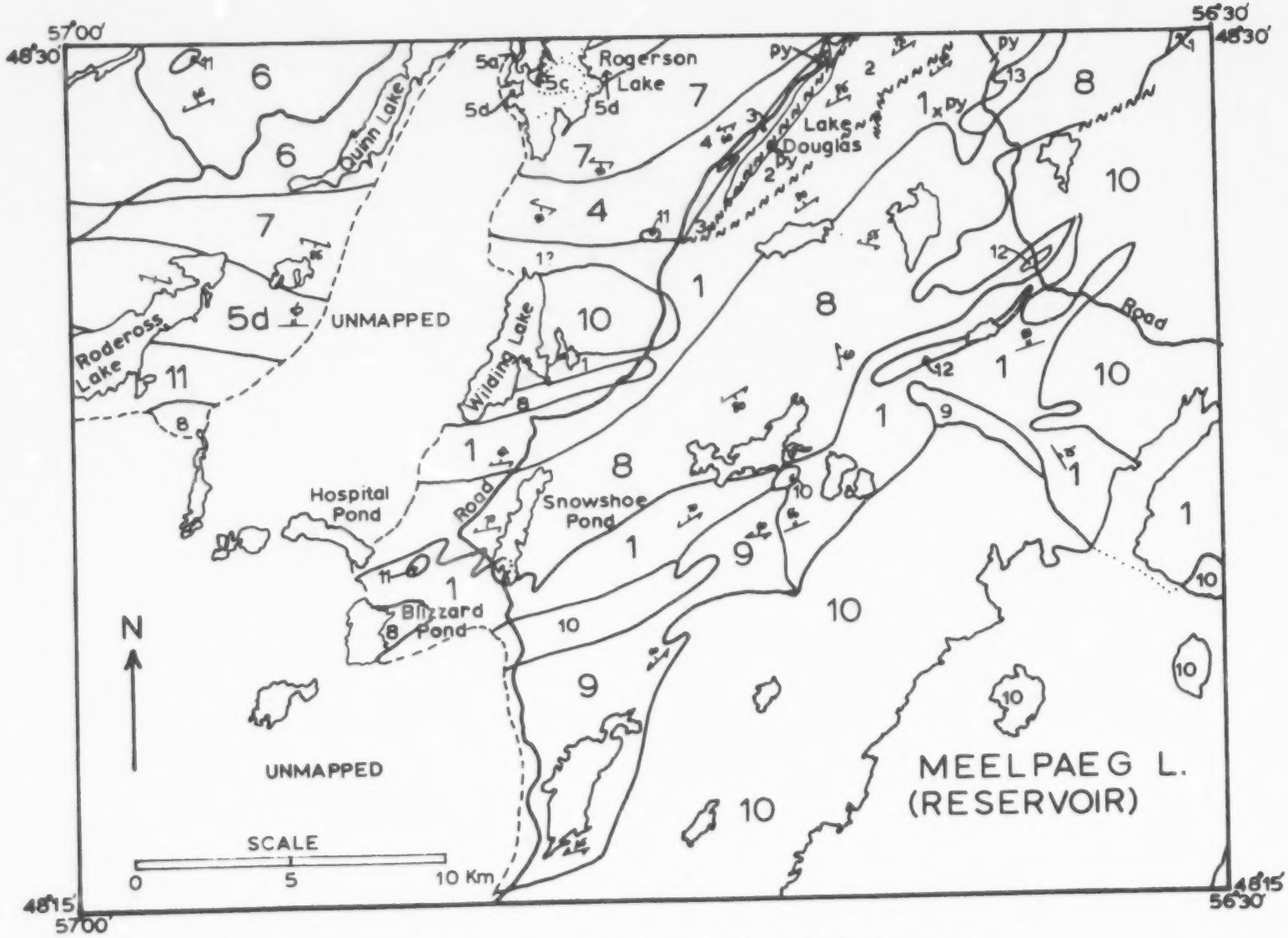

Figure 1. General geology of parts of the Snowshoe Pond (12A/7) map area.

The Rogerson Lake Conglomerate extends into the western part of the map area. Here it separates isolated exposures of sedimentary and minor mafic volcanic rocks of the Victoria Lake Group (Unit 6), from mafic volcanic and intrusive rocks, with associated breccia, conglomerate, sandstone and shale at the northeast end of Rodeross Lake (Unit 5d). The latter are tentatively included with the Tally Pond volcanics.

The mafic intrusion at Rodeross Lake consists principally of biotite-hornblende gabbro and diorite (Unit 11), but also includes a large lens of ultramafic rock. It is presumed to intrude rocks of Unit 5d and has a definite posttectonic intrusive contact with foliated granite of Unit 8.

The principal exploration targets in the area are:

1. Precious and base metals in the volcanic rocks of Units 2-6. These rocks are commonly pyritiferous and contain prominent gossans on the shores of Lake Douglas. Chalcopyrite has been reported in the Lake Ambrose area on the northeast-strike extension of Unit 2.

2. Tungsten mineralization in granitic rocks of Units 8, 9, 10 and 12.Although no occurrences were found in the Snowshoe Pond area, wolframite, scheelite, molybdenite and pyrite are present in quartz veins or as disseminations on joint surfaces in granitoid rocks in the Wolf Mountain area, less than 5 km to the south.

3. The mafic intrusion (Unit 11) at Rodeross Lake contains peridotite and pyroxenite phases and may have some similarities to Alaskan-type zoned ultramafic complexes. If so, there may be potential for concentrations of platinum-group elements.

A preliminary report on the geology of the Grand Bruit - Cinq Cerf area (110/9 and 110/16), southwestern Newfoundland

by

Brian H. O'Brien
Newfoundland Mapping Section

Following the completion of 1:50,000 scale geological mapping of the La Poile and La Poile River map areas, and the discovery of several precious-metal prospects near the Grand Bruit Highlands, the Mineral Development Division instigated a three-year study in the La Poile Bay - Couteau Bay area aimed at resolving several outstanding problems of regional geology and metallogeny. During this first (1986) field season a lithological map of the Grand Bruit - Cinq Cerf area was drawn on 1:20,000 scale. Sections illustrating the detailed structure of the lithological units were constructed for this region.

The area is underlain by a variety of volcanic, sedimentary, hypabyssal, plutonic and metamorphic rocks (Units 1-19), which may range in age from Precambrian to Devonian (Figure 1). With the exception of the posttectonic granite of Unit 19, all map units are ductilely deformed. Of the stratified deposits found in Units 4-12, volcanic rocks are more areally extensive than associated sedimentary rocks. Regional metamorphism of these units was probably in the greenschist facies. In contrast, Units 1, 2 and 3 consist of partially retrograded amphibolite facies schists and gneisses. Variably deformed, hypabyssal and plutonic rocks (Units 13-18) intrude both greenschist and amphibolite facies rocks. All of these intrusions were emplaced into previously folded and metamorphosed rocks during various stages of the regional deformation. Contact metamorphism is restricted to the aureole of Unit 19.

The amphibolites and migmatitic paragneisses in Unit 1 and the schists in Unit 2 were regionally metamorphosed to amphibolite facies prior to the intrusion of Units 13, 14 and 17. Atypically, the schists in Units 2 and 3 are regionally disposed in flatbelts. The Bay d'Est Fault separates the amphibolite facies rocks in Unit 3 from the greenschist facies rocks in Units 12, 11, 16 and 4.

The greenschist facies rocks in Unit 6 are intruded by Units 13 and 14 synkinematically, and are separated from Unit 2 by a swarm of basic dikes. Unit 6 contains mostly sedimentary rocks. Minor amounts of acidic pyroclastic material are, however, locally present, especially near the Unit 7 contact. Unit 5 occurs wholely within Unit 6 and represents the only mappable basic pyroclastic unit in the Grand Bruit - Cinq Cerf area. Unit 7 is a distinctive marker horizon of polymictic boulder conglomerates. Unit 7 conglomerates contain clasts with pre-incorporation foliations; as do conglomeratic bands in Units 10, 9 and 6. Units 8 and 9 are almost monolithic, whereas Unit 10 comprises several lithological subunits. Unit 11 is a relatively poorly exposed pyroclastic unit. The rhyolites in Unit 12 are the most extensive of all the stratified rocks.

The granitic porphyries of Unit 14 either passes gradationally from or are intrusive into Unit 13 granodiorite. Openly folded dikes of Unit 15 intrude Unit 13. Unit 13 intrudes mylonites probably derived from Units

1 and 6 and is itself mylonitized. Unit 14 is isoclinally infolded with Unit 6. Unit 16 granite porphyry intrudes Units 6, 7, 9, 10, 11 and 12. Some of the stratified rocks were locally inverted prior to the emplacement of Unit 16, and, in places, they were subsequently folded with the intrusion. Unit 17 granodiorite intrudes Units 1, 13 and 14, and is intruded by Unit 18 granodiorite. Mylonite zones in Units 17 and 18 are crosscut by Unit 19 granite.

Absolute age determinations have been made on Units 19, 13 and 8 in the area surveyed and on the southwestern extensions of Units 16 and 12 in the Grand Bruit Highlands. Unit 19 is thought to be Devonian, Units 16 and 8 to be Silurian, Unit 12 to be Ordovician and Unit 13 to be Cambrian (see legend, Figure 1).

The outcrop pattern depicted in Figure 1 does not have a singular explanation. Some crosscutting relationships are produced by intrusion, some by faulting and some by stratigraphic pinch-out. Map unit closures are caused by regional folding in some localities, and by lateral termination of lithofacies in other places. Most of the intrusive rocks were originally emplaced as steep, northeast-trending, lenticular bodies; however, some were deformed into this orientation.

Gold mineralization in the Grand Bruit - Cinq Cerf area is found in steep, northeast-trending, alteration zones. These alteration zones occur in a variety of stratified and intrusive rocks (Units 3, 6, 7, 9, 10, 12 and 16). Altered rocks are characteristically sericitized, pyritized and/or silicified. Most commonly, alteration zones are associated with acidic porphyries and zones of relatively strong deformation.

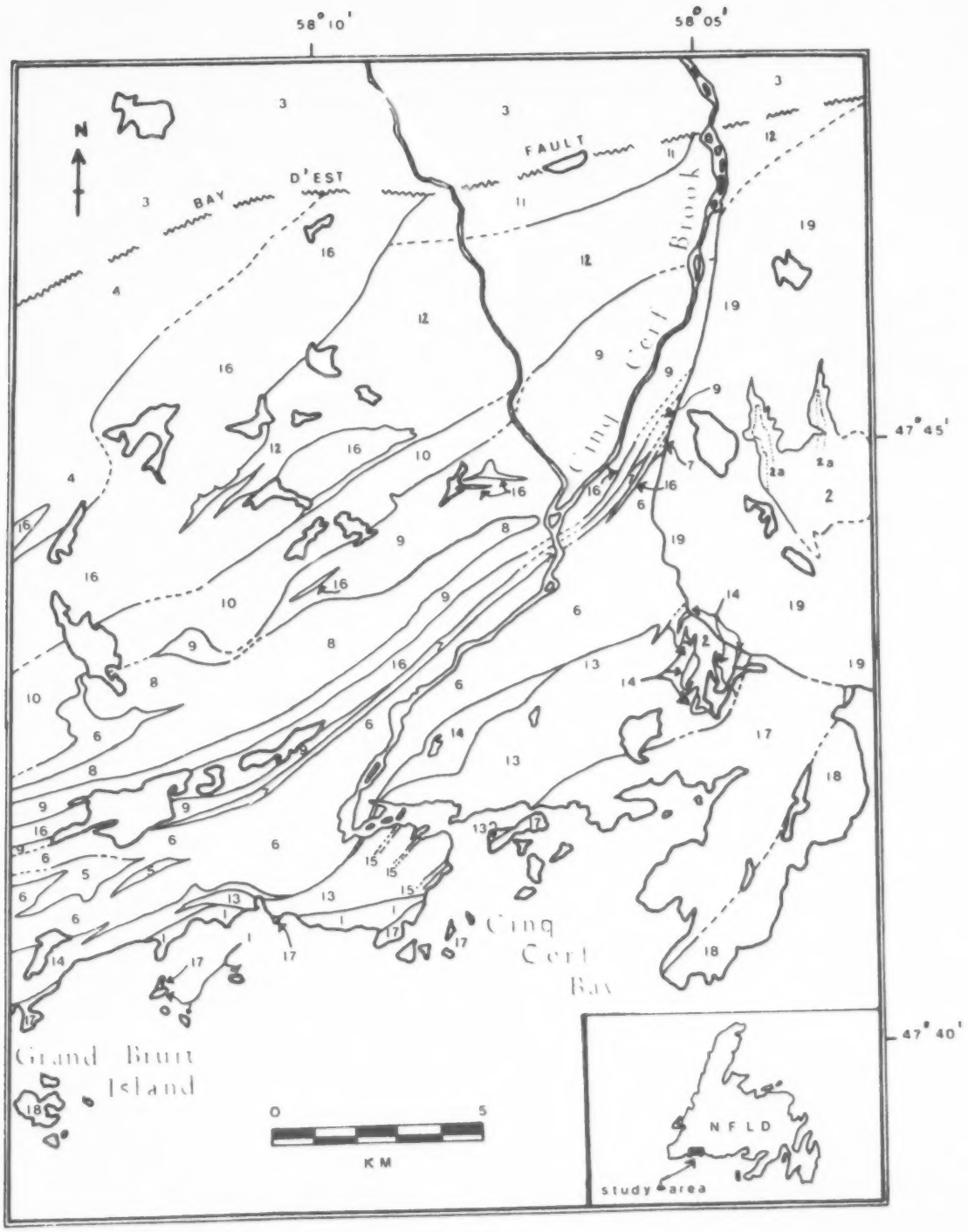

Figure 1. Geology of the Grand Bruit-Cinq Cerf Area, southwestern Newfoundland

LEGEND

(No stratigraphic order implied)

Map Unit	Field Description	Previously Assigned Names	Previously Assigned Ages
19	Pink, equigranular granite	Chetwynd Granite	Devonian
18	Porphyritic, biotite granodiorite containing abundant pegmatite sheets	Otter Point Granite	Devonian, Silurian
17	Equigranular, biotite-hornblende granodiorite containing cognate xenoliths	Cinq Cerf Complex	Devonian, Devonian or older
16	Fine grained, granite porphyry containing green, altered feldspars	La Poile Porphyry, Hawks Nest Pond Porphyry of the La Poile Group	Devonian, Silurian
15	Gabbro, diorite, intrusion breccia	Ernie Pond Gabbro	Devonian, Devonian or older
14	Leucomicrogranite and granite porphyries; locally contains abundant screens of country rock	Roti Granite, Roti Granite of the La Poile Group	Devonian, Cambro-Ordovician
13	Coarse grained granodiorite containing blue quartz	Roti Granite, Roti Granite of the La Poile Group	Devonian, Cambrian
12	Massive and flow-banded, pink and cream, rhyolite and rhyolite rhyolite breccia	La Poile Group, Georges Brook Formation of the La Poile Group	Devonian, Ordovician
11	Acidic, lithic-crystal tuff	as above	Devonian, Pre-Devonian
10	Welded tuff, acidic tuff-agglomerate, argillite, sandstone and conglomerate	as above	as above
9	Grits and wackes interbedded with minor argillite	as above	as above
8	Flow-banded and massive rhyolite	as above	Devonian, Silurian

7	Polymictic boulder conglomerate and interbedded minor sandstone	Basal La Poile Group, Georges Brook Formation of the La Poile Group	Devonian, Pre-Devonian
6	Sandstone and argillite, minor acidic tuff and conglomerate	Pre-La Poile Group (unnamed), Georges Brook Formation of the La Poile Group	as above
5	Basic tuff and agglomerate	as above	as above
4	Undivided sedimentary and volcanic rocks	La Poile Group, Georges Brook Formation of the La Poile Group	as above
3	Metaconglomerate, psammite and semipelitic schist; abundant screens of microgranite	Bay du Nord Group	Ordovician
2	Semipelitic and pelitic schist; 2a, metaconglomerate	Pre-La Poile Group (unnamed), Cinq Cerf Complex	Devonian or older
1	Paragneiss, amphibolite gneiss, metagabbro	as above	as above

Paleontological investigations in western and central Newfoundland

by

W.D. Boyce and J.S. Ash
Newfoundland Mapping Section

Western Newfoundland

Canada Bay

Lower and Middle Cambrian rocks of the Canada Bay region (Figure 1) were the target of detailed biostratigraphic sampling for trilobites. This work was done in conjunction with Dr. I. Knight, who did the detailed lithostratigraphic sections. The units investigated were the Forteau Formation, a lower, dominantly siliciclastic member of the Hawke Bay Formation, the Bridge's Cove member of the Hawke Bay Formation, and the March Point Formation. Particular attention was paid to the Bridge's Cove member, exposed along the western side of Chimney Arm, because abundant trilobites were discovered in this previously unsampled unit.

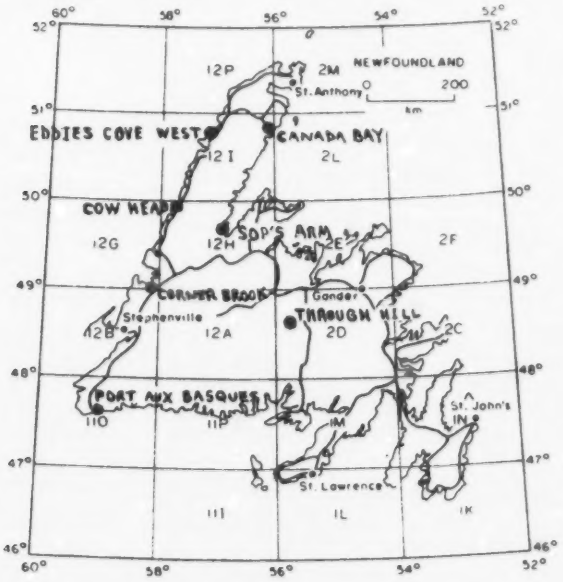

Figure 1. Areas of paleontological investigations, 1986.

The Bridge's Cove member is a sequence of interbedded oolitic and stromatolitic limestone, dolostone, quartz-rich sandstone and dense mudstone/shale; its thickness is approximately 90 m. It rests conformably upon a lower member (approximately 85 m thick) of fine grained quartz arenite, phyllite and gray Salterella-bearing limestone. Both members are stratigraphically equivalent to the Hawke Bay Formation of the western side of the Great Northern Peninsula. There, the Hawke Bay Formation mainly consists of unfossiliferous quartz arenite, but its lower part contains siltstone and shale that have yielded the late Early Cambrian Bonnia-Olenellus Zone trilobite Olenellus fremonti Walcott. The Hawke Bay Formation is overlain by the March Point Formation of late Middle Cambrian age.

Palmer and James (1980) postulated a circum-Iapetus regressive event near the Lower-Middle Cambrian boundary. This they called the Hawke Bay Event after the unfossiliferous Hawke Bay Formation. They suggested that, in western Newfoundland, most of the Middle Cambrian might be missing (Palmer and James, 1980, Figure 2).

This study aimed to test the validity of the Hawke Bay Event by collecting and identifying trilobites from the stratigraphically critical Bridge's Cove member. Possible Mexicella was obtained from several basal exposures of the member. The genus Mexicella ranges from the late Plagiura Zone to the early Glossopleura Zone (Robison, 1976, Text-Figure 3). Higher in the unit,

Glossopleura sp. cf. G. lodensis (Clark) was collected. Glossopleura lodensis (Clark) is a Glossopleura Zone species (Palmer and Halley, 1979). From the highest beds of the Bridge's Cove member, Ehmaniella cloudensis (Howell), suggestive of the Ehmaniella Zone of Robison (1976), was collected.

The presence of probable Glossopleura Zone trilobites in the Bridge's Cove member suggests that the Hawke Bay Event may be slightly less significant in western Newfoundland than first proposed.

Sampling of the Forteau Formation, the lower siliciclastic member of the Hawke Bay Formation, the Bridge's Cove member and the March Point Formation resulted in a significant increase in the number of Cambrian genera and species documented in the area. Howell (1943) described only ten species. His study was the first and only detailed investigation of the Middle Cambrian faunas here. Howell's species all require systematic redescription and revision, however, as the taxonomy of Middle Cambrian trilobites has changed considerably since his study.

Eddies Cove West

Biostratigraphic sampling of the Catoche Formation for trilobites and conodonts near Eddies Cove West was completed. The trilobites Bolbocephalus sp. nov. (Boyce, 1986; Plate 1, figures 1-6) and Illaenus sp. nov. were discovered in a previously poorly sampled, lime boundstone bed. Another graptolite horizon was also discovered in the section. It yielded one specimen of Pseudophyllograptus sp. A (Williams, in Williams et al., in press).

Cow Head to Corner Brook

Dr. S.H. Williams (Department of Earth Sciences, Memorial University) and Boyce are jointly studying new "autochthonous" Late Tremadoc trilobites from the Cow Head Group of the Humber Arm Allochthon. Boyce is also working with J.W. Botsford (Department of Earth Sciences, Memorial University) on late Middle Cambrian to Early Ordovician trilobite faunas recently recovered from the Cooks Brook Formation (Curling Group) of the Humber Arm Allochthon (Botsford et al., 1986).

Port aux Basques

Near Port aux Basques, carbonate-rich beds in the Windsor Point Group were investigated at three localities with J. Tuach (Newfoundland Department of Mines and Energy). One locality was along the Trans-Canada Highway. The other two were along the shore in John Cheeseman Provincial Park. No macrofossils were seen at any of the localities, but samples were taken for future conodont analysis.

Sops Arm

At Sops Arm, a galena-bearing limestone bed within the Simms Ridge Formation (Sops Arm Group) was visited with J. Tuach. This bed, which occurs approximately 300 m south of the Browning Prospect, yielded questionable corals and gastropods. Samples were taken for future conodont analysis.

Central Newfoundland

Through Hill

Trilobites and cephalopods collected in 1985 from limestone in the Spruce Brook Formation have been tentatively identified. The faunal assemblage is indicative of a Middle Ordovician (Llanvirn - Llandeilo) age. This basically agrees with the previous age determination based on brachiopods (Neuman, in Colman-Sadd and Swinden, 1984).

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Geology of the west half of the Weir's Pond (2E/1) map area

by

Pat O'Neill
Newfoundland Mapping Section

During the summer of 1986, the west half of the Weir's Pond (2E/1) map area was mapped at a scale of 1:50,000 (Figure 1).

A geological discontinuity is defined in the area between the Ordovician Davidsville Group (Dunnage Zone) and the undated Gander Group of the Gander Zone. The two groups are separated by the Gander River Ultrabasic Belt of early Ordovician (?) age.

Two units are defined in the Davidsville Group. Unit 1, in the northwest,comprises argillite, siltstone, minor granule sandstone and pebble conglomerate. Southeast of Unit 1, Unit 2 comprises boulder, cobble and pebble conglomerate, and granule and finer grained sandstone interbedded with argillite and siltstone. In one locality, southwest of Weir's Pond, the sandstone contains abundant fossils. Calcarenite, laminated calcareous beds and fossil-rich bioclastic limestone outcrop immediately west of Weir's Pond. Units 1 and 2 are probably gradational.

Southeast of Unit 1, a complex package of plutonic, volcanic and volcaniclastic rocks, which forms the Gander River Ultrabasic Belt, is structurally juxtaposed with Unit 2. The belt can be described in terms of the following subunits:

(1) The lowest definable structural member of the belt is an ultramafic rock of variable composition, which is locally altered to serpentine or a talc-magnesite assemblage.

(2) Gabbro commonly occurs northwest of the ultramafic member and contains pyroxenite pods in places. Banding, defined by alternating pyroxene- and feldspar-rich layers, was noted in several gabbro exposures. Diabase dikes exhibiting chilled margins (1-2 cm wide) intrude gabbro in one locality near the Gander Bay highway.

(3) Aphanitic, porphyritic and coarse grained trondhjemite occurs as separate bodies, and is also commonly associated with marginal areas of gabbro intrusions.

(4) Mafic volcanic and volcaniclastic rocks occur mostly on the northwest side of the ultramafic belt, and are locally intruded by trondhjemite and gabbro.

Unequivocal contact relationships between the Davidsville Group and the ultramafic belt are rare. However, on the west shore of Weir's Pond, bioclastic limestone and a thin graphitic shale appear to unconformably overlie serpentinized ultramafic rocks.

Although deformation effects within the ultramafic belt are heterogeneous, both in intensity and distribution, all rock types contain the northeast-southwest-trending regional foliation, which is best developed as a slaty cleavage in the Davidsville Group. This cleavage is axial planar to tight folds, which define the main deformation. The effects of a later

D_2 event are more brittle and heterogenously distributed.

East of Weir's Pond, the Gander Group comprises interbedded pelite, semipelite and psammite. Quartz-granule sandstone and mafic and felsic sills are minor components of the group. In the west, the metamorphic grade is greenschist, however, toward the centre of the map area a biotite isograd is defined; metamorphic grade is amphibolite facies farther east. Quartz-tourmaline veins are present in the biotite zone and farther east, beryl-bearing pegmatites are locally prominent.

Two phases of deformation are recognized in the Gander Group. The first and major phase (D1) is defined by isoclinal folds that have an axial planar cleavage; this foliation becomes a schistosity in the biotite zone. The second phase (D2) is defined by a crenulation cleavage, which is axial planar to open and tight asymmetric folds that have shallow plunges. This second cleavage appears to intensify eastward. A subhorizontal crenulation lineation (L2) is ubiquitously developed. Contact relationships between the ultramafic belt and the Gander Group are not exposed in the area.

Rocks within the ultramafic belt contain the most potential for mineralization. Trondhjemites are locally pyritic and patchily silicified. Ultramafic rocks are altered to talc and magnesite; networks of quartz veins are locally well developed. Magnetite and chromite pods occur sporadically in the ultramafic rocks.

Within the Gander Group, tourmaline and beryl occur in veins and pegmatites (respectively) close to granitic bodies in the centre of the area. Further mapping is required before these can be credited with any economic significance.

LEGEND

MIDDLE TO LATE ORDOVICIAN
DAVIDSVILLE GROUP

4 Thinly bedded argillite and siltstone, minor pebble conglomerate

3 Boulder to granule conglomerate, immature sandstone, siltstone, graphitic black shale, calcarenite, bioclastic limestone

EARLY ORDOVICIAN OR OLDER
GANDER RIVER ULTRABASIC BELT

2 Ultramafic (U), gabbroic (G), trondhjemitic (T), mafic volcanic and volcaniclastic (V) subunits

GANDER GROUP

1 Psammite, semipelite, pelite; minor quartz-granule sandstone and mafic and felsic sills

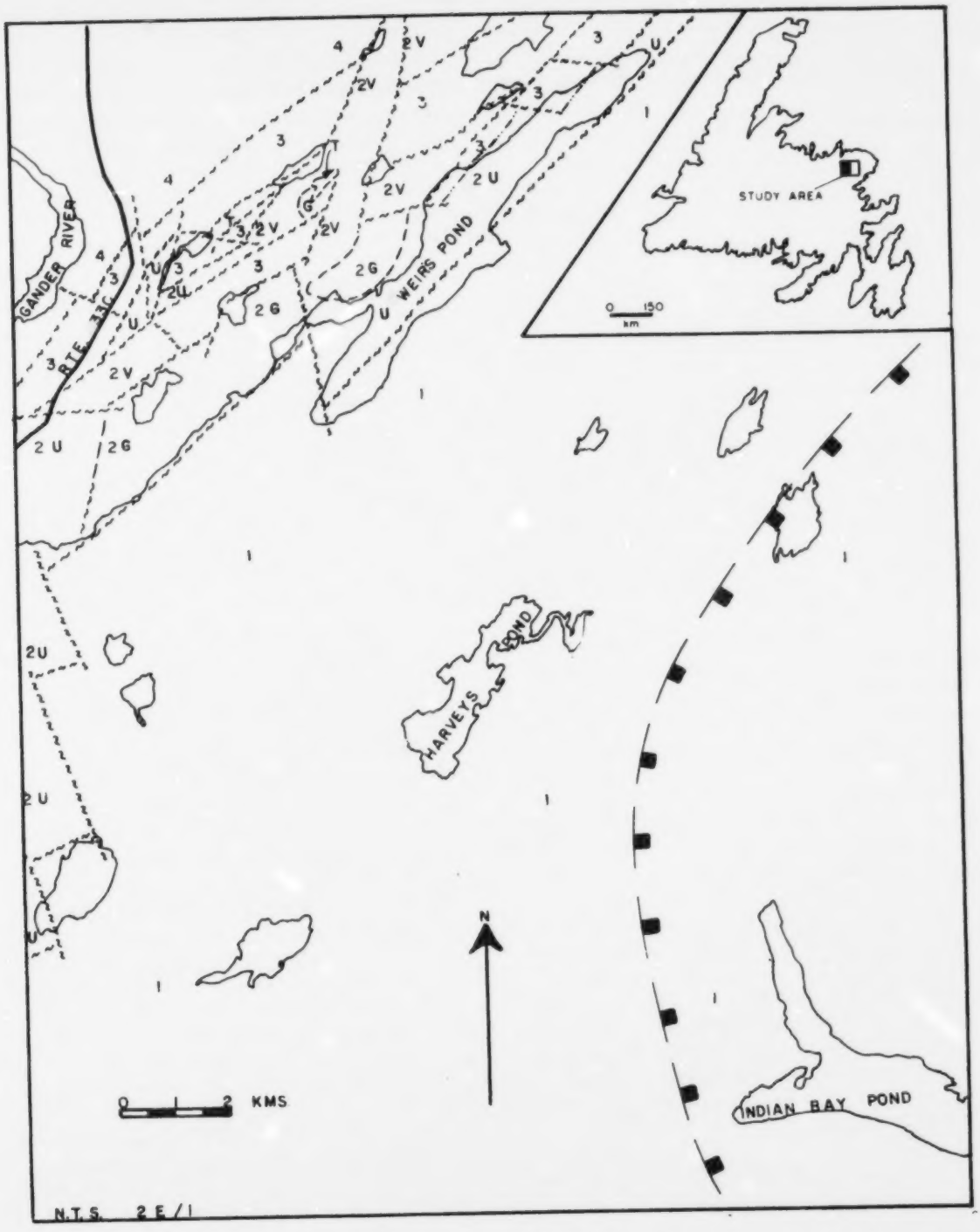

Figure 1. Geological map of the west half of the Weir's Pond (2E/1) map area.

Biotite isograd

Geological mapping of Cambro-Ordovician rocks in the Roddickton (121/16) map area

by

Ian Knight
Newfoundland Mapping Section

The Roddickton map area contains a southward-narrowing terrane of Cambro-Ordovician platformal rocks sandwiched between the Long Range Precambrian inlier to the west and the Lower Paleozoic Hare Bay Allochthon to the east. In 1986, 1:50,000 scale mapping of the platformal rocks, begun in 1979, was completed in the map area. The platformal succession comprises rocks of the Labrador, Port au Port, St. George and Table Head groups.

In the west of the map area, autochthonous platformal strata unconformably overlie Precambrian basement of granite and gneiss. In the east, however, the strata are parautochthonous, and are involved in a number of thrust sheets that were emplaced northwestward over autochthon, beneath or ahead of the Hare Bay Allochthon. Metamorphism of the strata is highest adjacent to the allochthon where sub-greenschist slate, phyllite and marble characterize the Cambrian and Ordovician succession. The thrust slices also provide an opportunity to examine changing lithofacies from northwest to southeast across the map area, as outlined previously by Knight and Saltman (1980).

Geological highlights of the map area are outlined below:

1) There is significant relief upon the Late Precambrian unconformity. A thin pebble lag, local regolith and smooth unweathered surfaces characterize the unconformity.

2) Columnar and massive basaltic volcanic rocks of the Lighthouse Cove Formation appear to fill lows in the unconformity. An extensively oxidized top to the basalts is marked by iron enrichment and unaltered basalt spheroids within red hematitic ring structure. This suggests that the top of the volcanic rocks was weathered before red pebbly arkose of the Bradore Formation was deposited by braided streams in the Early Cambrian.

3) Detailed stratigraphic and biostratigraphic sectioning of the Hawke Bay Formation (Labrador Group) shows significant fossiliferous, oolitic limestone and mudstone together with quartzose sandstone in the upper 90 m of the formation (informally called the Bridges Cove member). Trilobite faunas in these rocks suggest they span the late Early to early Middle Cambrian (see Boyce and Ash, this volume). The member rests upon a lower siliciclastic member approximately 85 m thick consisting of fine grained quartz sandstone, phyllite and rare beds of gray Salterella-bearing limestone.

4) The stratigraphy of the St. George and Table Head groups is essentially similar to that defined near Pistolet and Hare Bay (Knight, 1986). There is significant relief on the St. George - Table Head disconformity.

5) A number of east-trending porphyritic diabase dikes cut rocks of the Middle to Upper Cambrian Port au Port Group in the parautochthon just west of the Hare Bay Allochthon. Some of these dikes are pyritized, and all are affected by Taconic deformation.

6) Taconic deformation of platformal strata produced limestone and dolostone mylonite zones, thrust faults, recumbent and sheath folds, stretching lineations, C-S fabrics, structural thickening of Lower and Middle Cambrian shale and limestone, drastic thinning of Cambrian dolostone formations, and metamorphism of Ordovician limestone to marble. Later deformation produced northeast-trending cross faults and kink bands.

7) The Roddickton map area contains significant deposits of good quality pure limestone in strata of the St. George and Table Head groups. Metamorphism of these same strata in the parautochthon has produced deposits of white to gray marble. Galena-sphalerite showings occur in the Petit Jardin dolostone. Minor sphalerite and fluorite occurs at the base of the Boat Harbour Formation.

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Geology of the Lake Michel area, Long Range Inlier, western Newfoundland[1]

by

J. Victor Owen, Janet E.M. Campbell[2] and Frank A.R. Dennis[2]

Proterozoic crystalline rocks in the Lake Michel area of the Long Range Inlier of western Newfoundland comprise a basement gneiss complex intruded by granitic plutons of Grenvillian age. The gneiss complex consists of diverse, amphibolite to granulite facies, quartzofeldspathic gneiss, amphibolite, and subordinate paragneiss. The metasedimentary rocks include massive to layered quartzite, pelitic gneiss, and associated rocks. Migmatitic, biotite ± garnet ± sillimanite ± orthopyroxene ± graphite-bearing pelitic gneiss is typically intercalated with quartzite, and in places is part of an assemblage of rocks including banded, hornblende ± biotite ± orthopyroxene-bearing dioritic gneiss and/or biotite ± garnet ± pyroxene-bearing tonalitic gneiss, which may also have been derived from supracrustal rocks. The protoliths of diverse quartzofeldspathic gneiss, including granitic to quartz dioritic variants, remain equivocal, and may include rocks of both igneous and sedimentary origin. The gneisses were folded about northwest-plunging (F_1?) axes, apparently prior to the emplacement of the ca. 1042 Ma Lake Michel pluton and contemporaneous intrusive rocks. The Lake Michel pluton covers an area of approximately 1500 km^2. It consists of both megacrystic and non-megacrystic, biotite ± hornblende-bearing granitic to granodioritic rocks. These foliated granitoid rocks are cut by the ca. 605 Ma mafic dikes of the Long Range swarm, and are unconformably overlain in the northwestern part of the map area by conglomerate and arenite assigned to the pre-late Early Cambrian Bradore Formation. The major, east- dipping décollement postulated to separate the central part of the inlier from deformed Cambro- Ordovician platformal rocks in the foreland is either discontinuous to the northeast, or passes to the west of the Bradore Formation in this area.

[1] Contribution to Canada-Newfoundland Mineral Development Agreement 1984-1989. Project carried by Geological Survey of Canada, Lithosphere and Canadian Shield Division.

[2] Department of Geology, Acadia University, Wolfville, Nova Scotia, B0P 1X0

LEGEND

LOWER CAMBRIAN (?)

16 QUARTZ PEBBLE CONGLOMERATE, FELDSPATHIC QUARTZ ARENITE (BRADORE FORMATION)

PROTEROZOIC

14 LONG RANGE DYKES (NOT SHOWN)

GRENVILLIAN(?) PLUTONIC ROCKS (INCLUDES LAKE MICHEL PLUTON)

13 BIOTITE ± HORNBLENDE QUARTZ MONZODIORITE TO GRANODIORITE

12 MEGACRYSTIC HORNBLENDE + BIOTITE QUARTZ MONZONITE TO GRANITE

11 BIOTITE GRANITE

10 MEGACRYSTIC BIOTITE GRANITE

BASEMENT GNEISS COMPLEX AND ASSOCIATED ROCKS

9 BIOTITE GRANITE ASSOCIATED WITH GRANITIC GNEISS (MAY INCLUDE UNIT 11)

8 BIOTITE-BEARING GRANITIC TO GRANODIORITIC GNEISS

7 BIOTITE ± HORNBLENDE ± ORTHOPYROXENE-BEARING QUARTZ DIORITIC GNEISS, MINOR AMPHIBOLITE OR DIORITIC GNEISS

6 SCHISTOSE, PLAGIOCLASE-MEGACRYSTIC, BIOTITE-BEARING QUARTZ DIORITIC TO TONALITIC ROCK

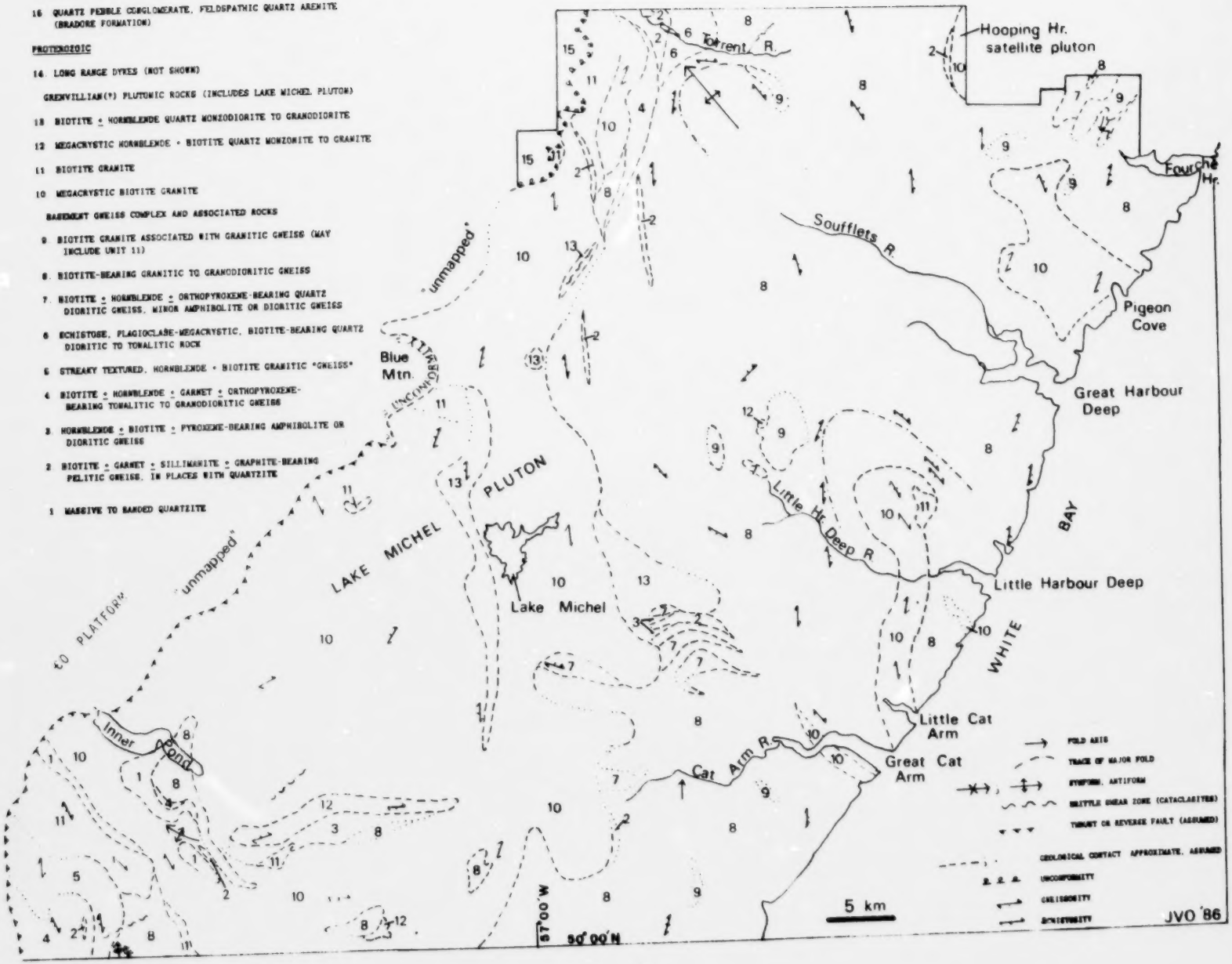
5 STREAKY TEXTURED, HORNBLENDE + BIOTITE GRANITIC "GNEISS"

4 BIOTITE ± HORNBLENDE ± GARNET ± ORTHOPYROXENE-BEARING TONALITIC TO GRANODIORITIC GNEISS

3 HORNBLENDE ± BIOTITE ± PYROXENE-BEARING AMPHIBOLITE OR DIORITIC GNEISS

2 BIOTITE ± GARNET ± SILLIMANITE ± GRAPHITE-BEARING PELITIC GNEISS, IN PLACES WITH QUARTZITE

1 MASSIVE TO BANDED QUARTZITE



GEOLOGY OF THE DASHWOODS POND (12B/1), ST.FINTAN'S (12B/2) AND MAIN GUT (12B/8) MAP AREAS, SOUTHWEST NEWFOUNDLAND

by

J.T. van Berkel*
Lithosphere and Canadian Shield Division
Geological Survey of Canada

Geological mapping of the Dashwoods Pond (12B/1), St.Fintan's (12B/2) and Main Gut (12B/8) map areas was completed in 1986. Along the entire length of the Long Range Fault intermediate and granitic gneisses (unit P3) form a continuous strip of Grenvillian basement across the map area. The The Grenvillian gneisses (unit P3) continue in the adjacent southern area (Grandys Lake area, 11O/15) if one reinterprets the mapping results by Chorlton (1983). The dominant rock type northwest of the Long Range Fault is a Grenvillian anorthosite (Steel Mountain anorthosite, unit P1) which contains minor facies of norite (unit P2a) and meta quartz-diorite to tonalite (unit P2b). Carboniferous sedimentary rocks (unit €) unconformably overly or are in fault contact with the anorthositic rocks (unit P1) and intermediate to granitic gneisses (unit P3).

Southeast of the Long Range Fault medium to high-grade metamorphic quartzofeldspathic rocks of the Cormacks Lake Complex (unit PC1) and metamorphosed clastic sediments (unit PC2) are invaded by syntectonic granite (unit O2). Together they are intruded by large late-tectonic plutons of granite (units O6a and b) and granodiorite (unit O6c), and smaller post-tectonic plutons of biotite leuco-granite (unit O7). The meta-sediments (unit PC2) contain numerous inclusions and strips of serpentinite (unit O1a), metamorphosed ultramafic rocks (unit O1a) and metagabbro (unit O1b). Well-preserved diabase(-gabbro) (units O3, O4 and O5) occurs in three different bodies. Several, generally small bodies of post-tectonic diorite (unit O8) were found throughout the region.

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* Geological Survey of Canada, 601 Booth Street, Ottawa, ontario K1A OE4

L E G E N D

CARBONIFEROUS

C Codroy* and Anguille* Groups: conglomerate,sandstone; minor shale,limestone,dolomite and evaporites

DEVONIAN

D Windsor Point Group*: grey sandstone, grit, mudstone, conglomerate (Emsian fossils, ± 372 Ma)

ORDOVICIAN

O8 South-west Brook Complex*(456 Ma): diorite

O7 medium-grained biotite leucogranite

O6 a, biotite granite; b, porphyritic granite; c, hornblende-biotite granodiorite

O5 Main Gut Complex*: diabase; minor gabbro

O4 fine to medium-grained diabase

O3 medium grained diabase with 5 -30% more mafic dykes

O2 a, gneissic granite; b, fine grained biotite leucogranite

O1 Ophiolite*(?): a, serpentinite, dunite, harzburgite, pyroxenite; b, metagabbro

LATE UPPER PROTEROZOIC TO CAMBRIAN

PC2 metasediments: a, psammitic and b, quartzitic and semipelitic rocks

PC1 Cormacks Lake Complex: a, quartzofeldspathic rocks; minor pelitic and quartzitic rocks; b, amphibolite

UPPER PROTEROZOIC (GRENVILLIAN)

P3 intermediate and grantitic gneisses; minor amphibolite and marble

P2 a, norite; b, meta quartz diorite - tonalite

P1 anorthosite*; minor gabbroic anorthosite and some amphibolite dykes

Geology by J.T. van Berkel and M.A.J. Piasecki, 1985,1986, D. Fox, T. van Nostrand, D. Machin and G. Goucher, 1986, and H.P. Johnston, J.C. Martin and S. Dawson, 1985.

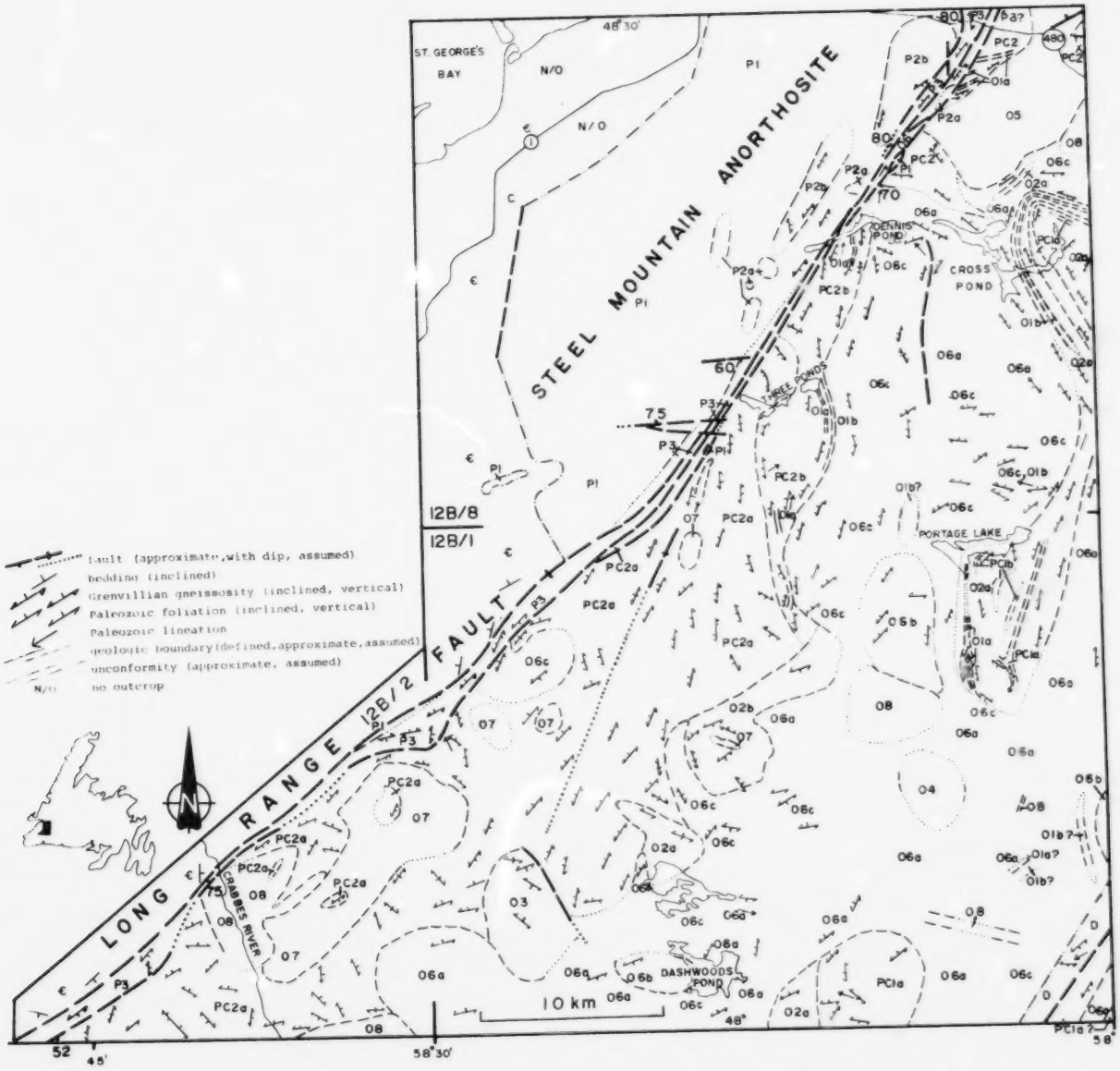

Fig. 1: *Generalized geological map of the Dashwoods Pond (12B/1), St. Fintan's (12B/2) and Main Gut (12B/8) map areas. An asterisk in the legend indicates that the age of the unit is reasonably well known. All other age assignments are speculative.*

GEOCHEMISTRY/GEOPHYSICS

Regional geochemical atlas of Newfoundland

by

Peter H. Davenport
Geochemistry and Geophysics Section

Data on Magnetic Tape or Flexible Diskette

The regional geochemical lake sediment data for Newfoundland are now available in digital form for each of the 18 1:250,000 NTS map areas. The data are available on standard 1/2-inch, 9-track, magnetic tape and on 5 1/4-inch, double-sided, double-density, flexible diskettes. The data on the magnetic tapes are written in EBCDIC format, and are available with sample locations in either latitude and longtitude or Universal Transverse Mercator (UTM) coordinates, standardized to Zone 21 (Newfoundland lies in Zones 21 and 22). The data on flexible diskettes are written in ASCII format, with sample locations in UTM coordinates only (again standardized to Zone 21). For all data sets, the identity of the geological unit underlying each sample site is recorded, using the 1:1,000,000 scale geological map of Newfoundland (Hibbard, 1983) as the source. The variables included on both tape and diskette versions are given in Table 1.

Data sets are available by 1:250,000 scale NTS map sheet at the following nominal costs:

1) Tape: $30 For the tape and the first data set;
$10 for the second and subsequent data sets on the same tape;
$200 for the entire 18-sheet set.

2) Flexible diskette:
$10 for each 1:250,000 scale NTS map sheet, except $20 for map 12A (2 diskettes);
$190 for the entire set

Table 1. Variables included in digital data sets of regional lake sediment geochemical data in Newfoundland.

NTS sheet (1:50,000)
Sample ID
Sample location - either longtitude and latitude (tape only) or UTM coordinates
Bedrock geology underlying sample site
Age of bedrock
Lake area (hectare)
Lake depth (metre)
Replicate status - whether sample is single, or a site or laboratory replicate
Nature of any contamination
Sample color
Zinc (g/t)
Copper (g/t)
Lead (g/t)
Nickel (g/t)
Cobalt (g/t)
Silver (g/t)
Manganese (g/t)
Molybdenum (g/t)
Iron (%)
Loss on Ignition (%)
Uranium (g/t)
Fluorine (g/t)

Table 2. Analytical methods used to measure element abundances in lake sediment

Atomic Absorption	Ion Selective Electrode	Neutron Activation	Inductively Coupled Plasma Spectrometer
Existing Suite	**Existing Suite**	**Existing Suite**	**Additional Elements**
Mn	F	U	B
Fe			(Na)
Co		**Additional Elements**	Mg
Ni			Al
Cu		As	P
Zn		Ba	K
Mo		Br	Ca
Ag		(Co)	Ga ?
Pb		Cr	Sr
		Cs	Y
Additional Elements		(Fe)	Zr
		Hf	Nb
Li		Na	(Ba)
Be		Rb	(Th)
Ti		Sb	
V		Sc	
(Rb)		Th	
Cd		(Zn)	
		La	
		Ce	
		Sm	
		Eu	
		Yb	
		Lu	
		Au	
		Se	
		Ta	
		W	

Note: Elements in parenthesis are also listed under another analytical method

Analysis of regional lake sediment samples by multi-element, non-destructive neutron activation

At present the lake sediment samples for Newfoundland have been analysed for the elements Cu, Pb, Zn, Co, Ni, Ag, Mo, F and U, together with the parameters Mn, Fe and L.O.I. This element suite was established, in large part, in response to the elements that were of interest in the early 1970's (base metals, tin, tungsten and uranium), together with parameters thus reflect the physico-chemical environment of sediment deposition (Mn, Fe and L.O.I.). This suite is strongly biased in favour of elements that can be readily determined by atomic-absorption spectrophotometry (AAS). With the current interest in precious metals and the development of neutron-activation analysis, and the inductively coupled plasma spectrometer (ICP), it has become both relevant and economically practical to determine a much greater range of elements, some of which may be pathfinders to precious-metal deposits. A study has been conducted that involved the multi-element analysis by neutron activation of 400 lake sediment samples from the province for gold and 28 other elements (As, Ag, Ba, Br, Ca, Co, Cr, Cs, Fe, Hf, Mo, Na, Ni, Rb, Sb, Sc, Se, Ta, Th, U, W, Zn, La, Ce, Sm, Eu, Yb and Lu). Of these elements, the non-destructive method proved capable of adequately measuring the observed element abundances in lake sediment for As, Ba, Br, Co, Cr, Cs, Fe, Hf, Na, Rb, Sb, Sc, Th, U, Zn, La, Ce, Sm, Eu, Yb and Lu. The neutron-activation data for Co, Fe, and Zn compare well with pre-existing data for these elements by AAS, and the U results compare well with previous U data by neutron activation. The detection limits of the method for Ag and Ni are too high to be useful, but data for both these elements have been determined by AAS. Detection limits for Au, Ca, Mo, Se, Ta and W are too high to measure the abundance of these elements in the majority of samples, but anomalous values of these elements are detectable.

Multi-element neutron-activation analysis offers a means of determining, non-destructively, 17 elements in addition to the existing AAS suite, as well as detecting anomalous values of five more elements. It may be possible to improve the sensitivity of some of these latter five elements, and also to determine Ir and Hg at levels low enough to permit measurement of their abundance in lake sediment. As well as neutron-activation analysis, a further five elements can be determined adequately by AAS (Table 2), and 11 elements by ICP. Some elements can be measured adequately by two or all three techniques, allowing cross-referencing of the different methods.

It now appears economically and practically possible to measure abundances in lake sediment of about 48 of the 84 elements with stable isotopes, four times the present number. Some of these elements are of direct interest in precious-metal exploration, and all will have application in regional geochemical mapping. Of the 36 elements not listed in Table 2, some can be determined adequately by specific techniques (eg., Si, S, Hg), and methods may be developed for other economically significant elements (eg., Sn and the platinum group).

Geochemical follow-up survey, Labrador Trough

by

James Butler
Geochemistry and Geophysics Section

Introduction

Field work for the 1986 season consisted of more detailed geochemical follow-up of the areas surveyed during the 1985 field season, and detailed lake sediment sampling of 3 areas of potential gold mineralization. In the Sawbill Lake area (locality A, Figure 1), approximately 50 km northeast of Labrador City, soil samples were collected from an area that is anomalous in Cu, Zn, Pb and Cd, as indicated by both lake and stream sediment samples from last year's work. Lake sediment samples were collected from an area immediately west of Sawbill Lake. From a base in Schefferville, Quebec, several anomalies in the Howell's River area (locality B, Figure 1) were surveyed in more detail by soil, rock and stream sampling. An extensive Pb anomaly near the Newfoundland-Quebec boundary was surveyed by establishing a grid and collecting "frost boil" material for analysis. Lake sediment samples were also collected from an area northwest of Menihek Lakes and near the McPhadyen River to the south. The soil grid at Iron Arm (locality C, Figure 1) was extended to the southeast for 800 m.

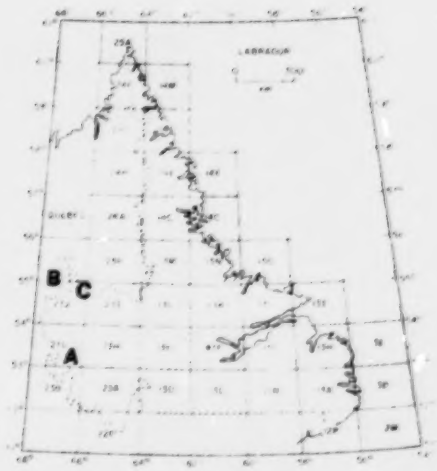

Figure 1. Index map of geochemical follow-up in the Labrador Trough: (A) Sawbill Lake; (B) Howell's River and (C) Iron Arm.

Sawbill Lake

Lake Sediment Sampling

An area of approximately 300 km2 was sampled immediately west of Sawbill Lake (locality 1, Figure 2). The area is believed to have some potential for mineralization based on the regional lake sediment survey conducted by the Geological Survey of Canada in the early 1980's. A total of 92 samples were collected for a sample density of one sample per 3.3 km2. These samples will be analysed for the usual suite of elements, which includes Cu, Pb, Zn, Co, Ni, Ag, Cd, Mn, Fe, and L.O.I., as well as for Au and pathfinder elements.

Soil Sampling

The field work last season revealed anomalous values close to the esker to the northeast of Sawbill Lake (locality 2, Figure 2). The northern part was indicated by a lake sediment anomaly and the southern part by a stream sediment anomaly. Using the esker as a base line, soil samples were collected from 17 km of lines to the east and west of the

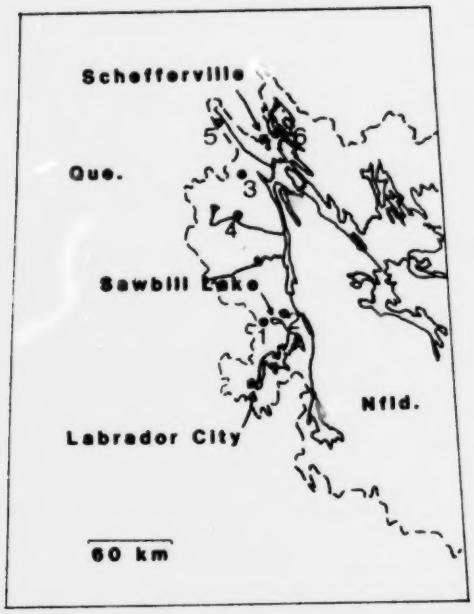

Figure 2. Areas of detailed geochemical follow-up: (1) lake sediment sampling and (2) soil grid at Sawbill Lake; (3) lake sediment sampling at Menihek Lakes; (4) lake sediment sampling at McPhadyen River; (5) soil grid and detailed stream and soil sampling near Kivivic Lake; (6) soil grid at Iron Arm.

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esker. A total of 270 soil samples were collected at 50-m intervals along 1000-m lines approximately 400 to 500 m apart. These samples will be analysed for Cu, Pb, Zn, Ni, Co, Ag, Mn, Fe, Cd and L.O.I.

Schefferville

Lake Sediment Sampling

Two areas were surveyed by collecting lake sediment samples. One area was immediately south of Schefferville near the north part of Menihek Lake (locality 3, Figure 2). A total of 126 lake sediment samples were collected from approximately 460 km2. The second area is immediately south of the first area, near the McPhadyen River (locality 4, Figure 2). Here 231 lake sediment samples were collected from an area of approximately 580 km2. These samples will be analysed for the usual suite of elements as well as Au and pathfinder elements.

Other Sampling

Several anomalies, which were indicated in the Howell's River area by the 1985 field survey, were looked at in more detail with the intention of revealing a source for them. Soil samples were collected at regular intervals around lakes, the sediment of all in-flowing and out-flowing streams was sampled, and rock samples were collected where available. No immediate indications of mineralization were noted, except for abundant pyrite in numerous localities and possibly some copper in some samples.

One area southwest of Kivivic Lake (locality 5, Figure 2) near the Newfoundland-Quebec boundary contains several streams and lakes that were anomalous in Pb and minor Ag. This area is in the Archean Superior Province and could possibly contain a continuation of the Au mineralization that is actively being explored in Quebec. A grid was established and "frost boil" samples were collected at 50-m intervals on 1000-m lines from this grid. These samples will be analysed for the usual suite of elements, as well as Au and pathfinder elements. Several rock samples (both float and outcrop) were also collected from this area; these are similar in appearance to samples from the Quebec Au showing. They will be analysed for Au and pathfinder elements.

Iron Arm Soil Grid

Additional work conducted last year on the soil grid at Iron Arm

(locality 6, Figure 2) did not prove anything conclusive about the origin of the Zn anomaly. The source for this anomaly may lie south of the grid area (F. Thompson, personal communication, 1986), based on recent work on ice movement in the vicinity of the grid. In this regard, the soil grid was extended southeastward approximately 800 m. Lakes and bogs in this area made sampling difficult, so that it was necessary to run 500-m lines from the lakes to the east and west. About 44 samples were collected and will be analysed for Cu, Pb, Zn, Ag, Co, Ni, Mn, Fe, Cd, and L.O.I.

An evaluation of geochemical exploration methods for gold prospecting

by

John McConnell and Stuart Wells
Geochemistry and Geophysics Section

Introduction

Exploration for gold mineralization has eclipsed that for all other commodities in the past few years. With the recognition that Newfoundland has significant gold potential, the geochemistry section has undertaken a project to evaluate the effectiveness of a variety of geochemical prospecting approaches. Techniques used in the search for base metals do not necessarily lend themselves to an identical application in exploration for precious metals. The extremely low absolute abundances and the "nugget effect" are two factors that may impede the prospector in obtaining a representative sample and analysis of the chosen sample medium. Other related factors influencing the quantity and particle size of gold in transported media include the grain size of gold in primary bedrock mineralization, transport history, and possibly the action of soil chemistry.

Sampling Methods

In an attempt to determine their effects in the Newfoundland surficial environment, nine known gold occurrences in four areas were selected for study during 1986 (Figure 1). Various sampling approaches were taken in the different areas; these are summarized in Table 1.

Soil sampling was conducted along lines up to 2 km long oriented both parallel and perpendicular to ice movement. Both conventional and oversize samples of soil were collected. Analyses will be made of various size fractions and of heavy-mineral concentrates. Concentrates were prepared in the field from sieved (-0.28 mm) material using a mechanized gold pan (Goldhound). Pebble counts from sampled material will be used as an aid in determining provenance and transport distance.

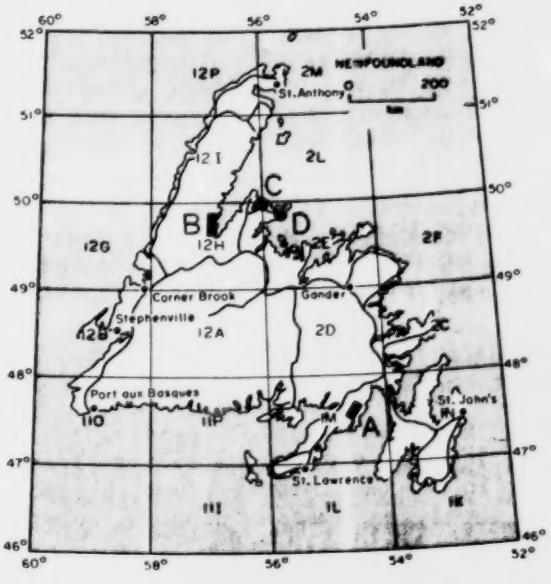

Figure 1. Location of study areas:
A. Hickey's Pond - Monkstown Road
B. Western White Bay
C. Ming's Bight
D. Betts Cove

Stream sediment was also collected in some areas. The method consisted of obtaining 20 L of -10 mm material, which was further reduced by wet seiving to -0.28 mm. This material will be analysed after concentration by heavy liquids.

Table 1. Quantity of samples by area and medium

	Hickey's Pond-Monkstown Rd.	White Bay	Ming's Bight	Betts Cove
Soil	420	280	280	44
Stream sediment		19		
Stream water		20		
Lake sediment		64		
Rock	38	11	4	1

One litre samples of filtered and acidified stream water were collected in duplicate from ten sites, including some downstream and some remote from mineralized areas. Samples were reduced to a 25 mL concentrate in camp on the day of collection, using a modified method of methyliscbutyl ketone (MIBK) extraction described by Brooks et al. (1981).

Duplicate lake sediment samples were collected in the western White Bay area to further evaluate the usefulness of this method in gold exploration. Previous work around gold occurrences in southwest Newfoundland (McConnell, 1985) suggest the approach is promising.

Rock samples were collected from the various gold occurrences to provide background data on gold contents and, more importantly, on associated trace element geochemistry.

Field Areas - Geology and Mineralization

Hickey's Pond - Monkstown Road Area

Dispersion in soil around four gold occurrences was studied. Three (the Monkstown Road, Bullwinkle and Strange showings) are accessible by foot from the Monkstown Road. The Hickey's Pond showing is 9 km southeast of the Burin Highway and is best reached by helicopter.

Bedrock exposure is less than five percent; most occurs on knobs and ridges or in river beds. The area is covered extensively with poorly drained till. Glacial landforms indicate that ice movement was southeasterly. The mineral occurrences are hosted by volcanic rocks of the late Precambrian Love Cove Group. They are discussed in detail by Huard and O'Driscoll (1984, 1985) who conclude, on the basis of textural, mineralogical and field observations, that the mineralization formed either as very high level epithermal deposits or as siliceous sinters at the surface. Grains of native gold up to 0.03 mm in diameter were reported. The highest gold values described were from grab samples from the Hickey's Pond (5 g/t) and Strange (1g/t) occurrences.

Western White Bay Area

Field work this summer focused on three of the numerous gold occurrences known from this area. One of these, the Browning deposit, received small-scale mining efforts near the turn of the century (Snelgrove, 1935).

The area is very rugged with extensive till cover and areas of marine clays and beaches near the coast. Sampling was not done in areas of marine overlap. Till thickness in valleys reaches several metres and thins out on the uplands. The

presence of rounded pebbles of diverse rock types within the soil at several, but not all, localities indicates that this area may be the most difficult to interpret in terms of till provenance and in regard to the relationship of soil chemistry to local bedrock. Current Quaternary mapping (Vanderveer and Taylor, this volume) suggests that this area experienced two directions of glacial flow - an earlier easterly flow off the Long Range Mountains and a later north to northeasterly one.

The most recent regional bedrock mapping is that of Smyth and Schillereff (1981, 1982) and Erdmer (1986). Most of the gold occurrences are in Silurian volcanic and sedimentary rocks of the Sops Arm Group to the west of the Doucers Valley Fault System. Features common to many of the mineralized sites include pyrophyllite-sericite-chlorite-carbonate-silica alteration. A review of the field evidence has led Tuach (1986) to propose a genetic model based on epithermal-fumarolic activity.

Much exploration attention is now focused on the Grenvillian granitoid rocks to the west of the fault system, where significant gold mineralization was discovered recently. The gold is associated with fractures, shear zones and subtle alteration features indicative of a medium- to high-temperature hydrothermal system (Tuach and French, 1986).

Field work concentrated on soil sampling over two occurrences (the Browning deposit and the Wizard showing) in Paleozoic rocks and over one (the Jackson's Arm showing) in the Grenvillian granitoids. In addition, lake sediment, stream sediment, stream water and rock samples were taken across the general area.

Ming's Bight Area

Field work focused on soil sampling across the old Goldenville Mine area, one kilometre north of the town of Ming's Bight. Outcrop is scarce, except along the coast, and the surface is covered by a thin veneer of locally derived till. Glacial striae and boulder composition indicate a history of northeasterly glacial flow. Mineralization is associated with ferruginous chert and iron formation. The iron formation is intercalated with mafic volcanic and volcaniclastic rocks and graywacke of either the Point Rouse ophiolite or its overlying cover (Hibbard, 1983). The age of the rocks is not known with certainty, but is thought to be Cambrian or Early Ordovician. Between 1904 and 1906, approximately 175 ounces of gold were recovered from underground workings (Watson, 1947), and the area is again receiving exploration attention.

Betts Cove Mine Area

Two days of field work were done in this area. Outcrop is abundant and till coverage is thin and patchy. Glacial boulders are composed of rock types of both distant and local occurrence. The orebody was mined for copper from 1875 to 1883, until closed by a catastrophic landslide. Mineralization is massive pyrite and subordinate chalcopyrite, sphalerite, gold and silver (Hibbard, 1983). The deposit occurs in the Betts Cove Complex, a Cambrian or Early Ordovician ophiolite sequence. It is considered by Upadhyay and Strong (1983) to be volcanic exhalative in origin, forming at the contact between sheeted dikes and overlying pillow lavas.

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Gravity Surveys 1986

by

Hugh G. Miller[1]
Geochemistry and Geophysics Section

The main focus of concentration for gravity surveys in 1986 was the Ackley Granite suite (Figure 1), where an additional 72 gravity stations were occupied to supplement the data available from the 1983 and 1985 surveys.

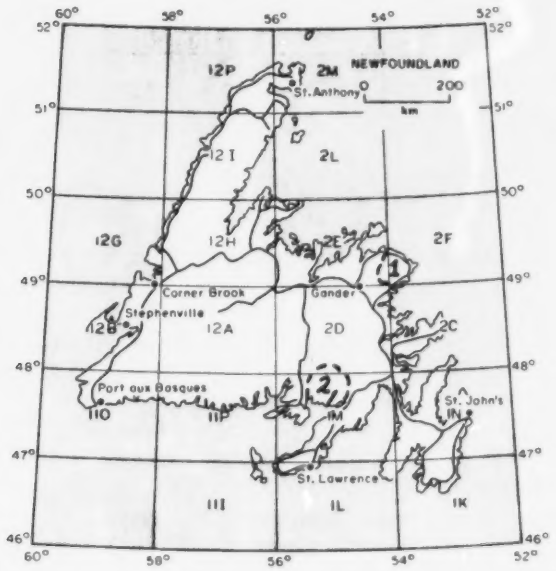

Figure 1. Location of gravity surveys: 1 - northern Gander Terrane; 2 - Ackley Granite suite.

These new data were used with the older data to provide information on the subsurface configuration of the various units of the Ackley Granite suite. Inversion of the gravity data demonstrates that the deepest portions of the granite are associated with the southern portions of the granite suite,where the granite thickness exceeds 5 km. Modelling of the gravity and magnetic data suggests that the granite south of the Dover-Hermitage Bay Fault is underlain by mafic volcanic rocks (Miller, 1986, in press). The Ackley Granite suite appears to have been intruded along northwest-trending lineations that mark fault lines along which blocks of Avalon Zone volcanic rocks foundered into the underlying magma (J. Tuach, personal communication, 1986).

Interpretation of the 1985 data collected in the northern Gander Terrane was also undertaken in conjunction with the aeromagnetic and geochemical data for that area. The combined interpretation of these data reveals the presence of a pair of northeast-trending lineations associated with geophysical and geochemical anomalies east of the GRUB line. These are probably related to thrust sheets of mafic-ultramafic rocks, which may reach the surface in these areas. The full interpretation for this area is currently in press (Miller, 1986).

Gravity data were collected on the Bonavista Peninsula at a 2.5-km spacing and in Trinity Bay and Bonavista Bay at a 5.4-km spacing as part of a joint mapping program with Memorial University. These data have not yet been interpreted.

The 1985 data from the Burgeo Road have been released as Open File

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[1] On sabbatical leave from Department of Earth Sciences, Memorial University of Newfoundland, until August 31, 1986.

NFLD 1503, and a preliminary interpretation, in conjunction with the latest Geological Survey of Canada and Newfoundland Department of Mines and Energy geological information, is being used in the planning of more extensive mapping in that area.

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Regional reconnaissance geochemical surveys, northern Labrador[1]

by

Peter W.B. Friske
Geological Survey of Canada

As part of the Canada - Newfoundland Mineral Development Agreement (1984-1989), a regional stream sediment and water survey was carried out by the Geological Survey of Canada (GSC) covering approximately 16,000 km2 in northern Labrador (Figure 1). Samples were collected from a total of 1,244 sites, for an average density of one sample per 13 km2.

Stream sediments will be analysed for Zn, Cu, Pb, Ni, Co, Ag, Mn, Cd, Fe, Mo, V, As, Hg, U, LOI, F, Sb, W, Ba, Sn and Au. Stream waters will be analysed for U, F and pH. Survey results will be released in the summer of 1987 as GSC Open File 1354, consisting of sample location and value maps at 1:250,000 scale, and a text containing field, analytical, and statistical data.

The survey area encompasses the northern Nutak (Nain) and parts of the eastern Churchill Province. The Nutak Province consists of a diverse assemblage of granitic gneisses, migmatites and metasedimentary rocks along the coast; a more orderly assemblage of north-trending Aphebian amphibolite and granulite facies sedimentary and igneous gneisses, mylonitized adjacent to the Nutak boundary, occur in the eastern Churchill Province. Minor agmatites and anorthosites occur in the northern part of the survey area.

The 1986 survey completes regional reconnaissance geochemical coverage of Labrador. A total of 18,865 lake sediments and waters and 1,244 stream sediment and waters have been collected from the Labrador land area of approximately 300,000 km2.

Results of the 1985 lake sediment and water survey, covering approximately 24,000 km2 at an average density of one sample per 13 km2 (Figure 1), were released on July 23, 1986, as GSC Open File 1209 (Newfoundland OF LAB 694) and GSC Open File 1210 (Newfoundland OF LAB 695). Open File 1209 (covering parts of 14C, D and 24A) relates to data acquired in 1985 under the Canada - Newfoundland Mineral Development Agreement (1984 - 1989), as well as previously released data acquired in 1978 under the Canada - Newfoundland subsidiary Agreement 1976-1982 (previously released as GSC Open File 559). Lake sediments were analysed for Zn, Cu, Pb, Ni, Co, Ag, Mn, Cd (only 14C, 24A), Fe, Mo, V (only 14C, 24A), As, Hg, U, LOI, F, Sb (only 14C, 24A), W (only 14C, 24A). All water samples were analysed for U, F and pH. Open File 1210 relates only to data acquired in 1985, and covers parts of 14E, F, L; 24H, I. Lake sediments were analysed for Zn, Cu, Pb, Ni, Co, Ag, Mn, Cd, Fe, Mo, V, As, Hg, U, LOI, F, Sb, and W. Uranium, F and pH were determined on the waters.

Copies of the Open Files relating to the 1985 and 1986 survey data are, and will be available from the Newfoundland Department of Mines and Energy, St. John's and Campbell Reproductions, Ottawa. Copies for viewing are available at all GSC libraries, and digital data are available from the Computer Science Centre, EMR, Ottawa.

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1 Contribution to Canada-Newfoundland Mineral Development Agreement (1984-1989). Project carried by the Geological Survey of Canada

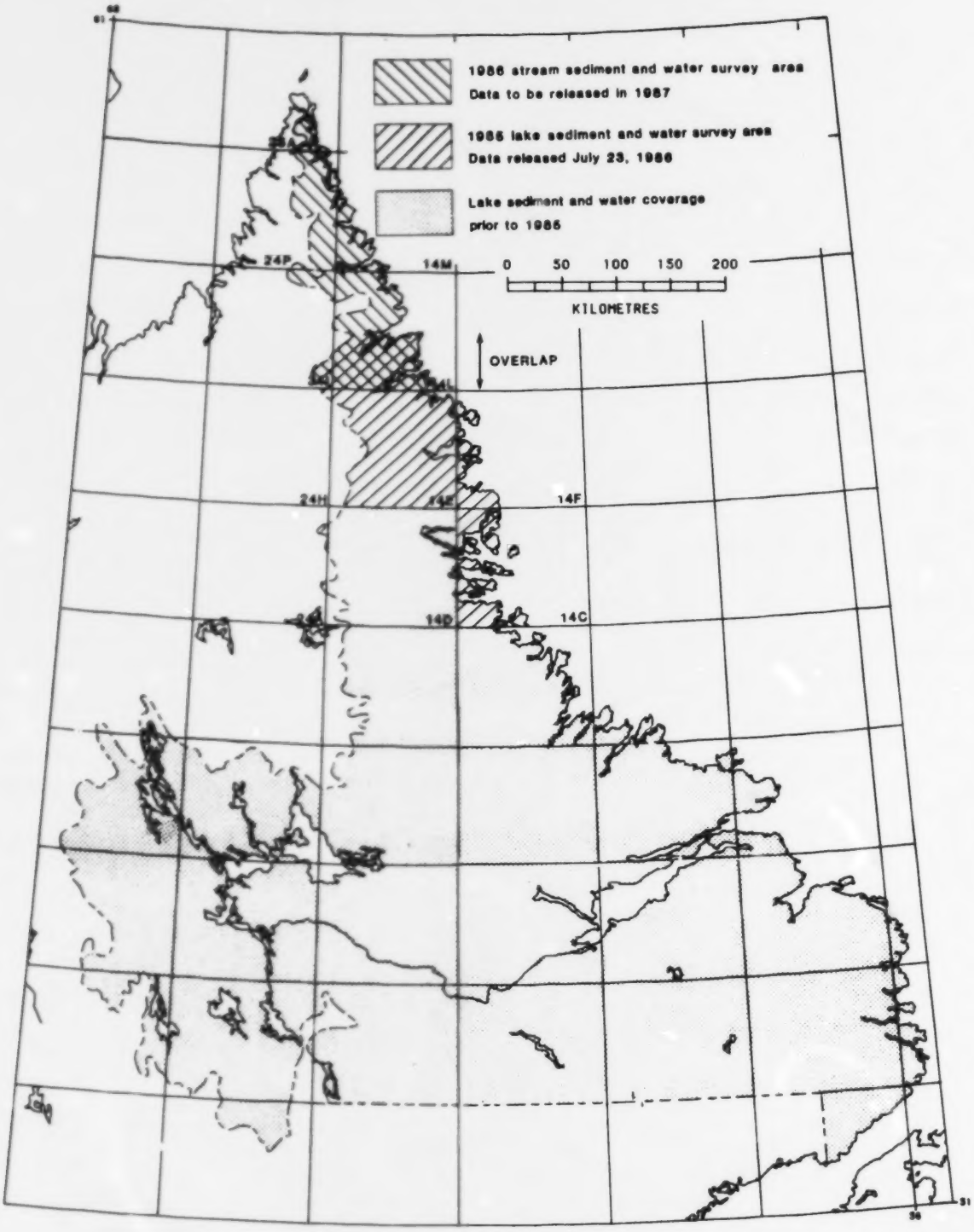

Figure 1. National Geochemical Reconnaissance survey coverage in Labrador.

Regional reconnaissance geochemical surveys, northern Labrador[1]

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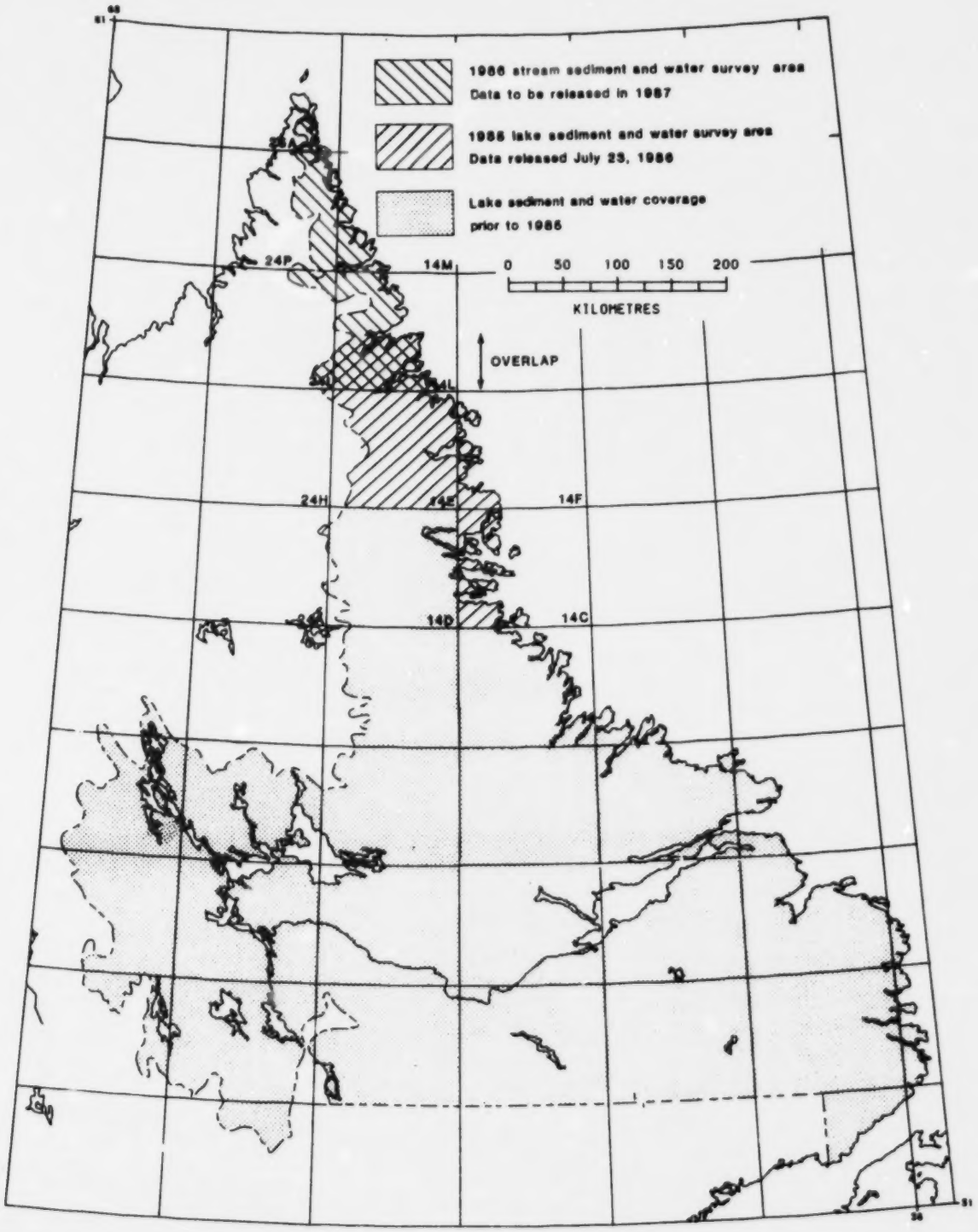

Figure 1. National Geochemical Reconnaissance survey coverage in Labrador.

QUATERNARY GEOLOGY

Quaternary Commodities - Diatomaceous Earth

by

Dan Bragg
Quaternary Geology Section

The 1986 field season concentrated on known occurrences of diatomaceous earth (D.E.) in selected areas of the Avalon Peninsula (Figure 1). Detailed investigation and mapping were carried out to determine the quality and quantity of D.E. for possible industrial use. Field work consisted of obtaining core samples from bogs and around ponds to determine the thickness of the deposit, and for chemical analysis.

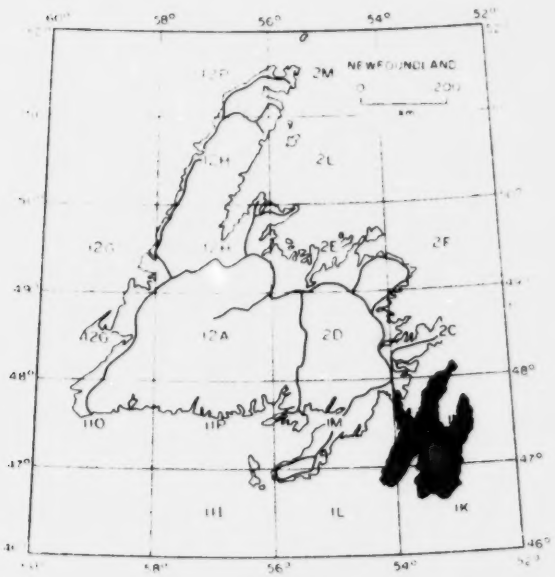

Figure 1. Location of Study Area

For the first six weeks of the field season, work was centred around the Carbonear area, with special emphasis on the Beaver Pond, Victoria area. This site was chosen because of its potential for having a large quantity of D.E. (Fletcher, 1965). A total of 55 core holes were drilled and 48 core samples taken.

The average thickness of the D.E. found in the bog at the head of Beaver Pond was 0.5 m, however at 5 sites the thickness ranged from 1.4 to 2 m. None of the D.E. was a pure white color, but ranged from bluish-gray to light brown, and all samples have organic material, which varied from 20 to 40 percent organics.

Other sites visited in the area were Western Bay, Perry's Cove, Northern Bay, Hant's Harbour, Heart's Content, Heart's Desire, Bryant's Cove and North River. No large amounts of D.E. were found in these areas, eg., ranging from 2 cm to 0.5 m thick, and all contained significant amounts of organics (20 to 40 percent).

The last 2 weeks of the summer field season were concentrated on the Southern Shore of the Avalon Peninsula. The areas visited were Trepassey, Portugal Cove South, Cape Broyle, Ferryland and Tors Cove.

No large amount of D.E. was found in these areas, and all sites contained significant amounts of organics, except for the Tor's Cove area where 2 core samples of 1 m thickness were taken of pure white D.E.

A total of 300 core holes were drilled and 165 samples taken. Data on these samples should be available in early 1987.

The rest of the field program is to be carried out this winter; it will entail core sampling through the

ice in a grid system on ponds chosen during the summer field season.

Acknowledgements

The author wishes to thank Mr. Glenn Norman, a hard working and capable assistant.

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Detailed Aggregate Resource Project - Newfoundland and Labrador

by

F.T. Kirby
Quaternary Geology Section

Detailed aggregate resource assessments were conducted within a number of municipal planning areas in Newfoundland and Labrador during 1986. The areas of the province included in the field program were: (A) St. George's - Stephenville Crossing (Figure 1), (B) Eastport - Traytown - Glovertown (Figure 1), (C) Happy Valley - Goose Bay - North West River (Figure 2).

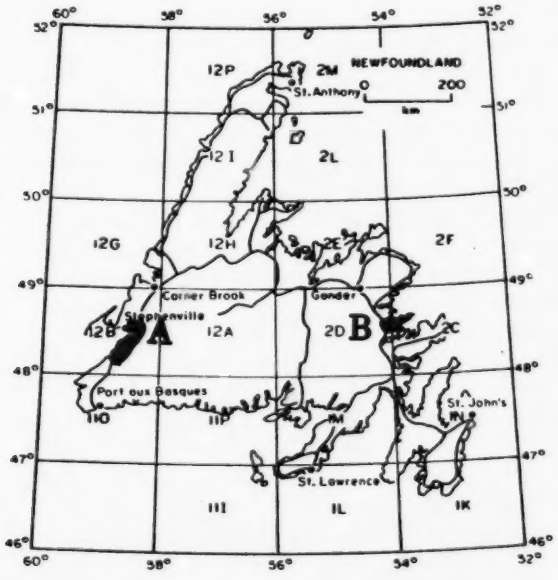

Figure 1. Newfoundland field areas, 1986.

A. St. Georges - Stephenville Crossing (12B/7,8,9,10)

Existing aggregate resource data (Kirby et al., 1983) and landform classification data indicate that approximately 50 percent of the planning areas contain reserves of sand and gravel.

This year's work involved the re-evaluation of existing aggregate resource data for the municipal-plan areas, and the determination of target areas for more detailed evaluation. Spot sampling was then conducted throughout the area to confirm the finding of previous work. Areas were then selected for backhoe test-pitting to better evaluate the true extent and quality of the deposits. A total of 15 areas were identified as containing suitable aggregate resources to meet the present and future aggregate requirements of the area. The results of this survey have been forwarded to the Department of Municipal Affairs for inclusion into municipal plans that are now in preparation. In total, 154 samples were collected for particle-size and petrographic analyses.

B. Eastport - Traytown - Glovertown (2C/12, 2D/9)

The study has verified that all three communities are built on extensive glaciofluvial outwash deposits.

In the Eastport area, extensive deposits of sand and gravel have been largely sterilized by urban-type developments and private land ownership.Two areas have been identified as containing aggregate materials suitable to meet the aggregate needs of the area.

At Traytown, the whole of the outer portion of the outwash deposit has been sterilized by urban development. A portion of the deposit farther inland was backhoe test-

pitted, and was found to contain reserves suitable to meet the aggregate needs of the area.

In the Glovertown area, much of the outwash deposit has been sterilized by urban-type developments and private land ownership. A large sand deposit situated along both banks of the Terra Nova River contains a large reserve of sand, but due to the height of the water table in the area, quarry faces of 1-2 m can be expected. Much of this area is contained within a community pasture. In total, 65 samples were collected in this area for particle-size and petrographic analyses.

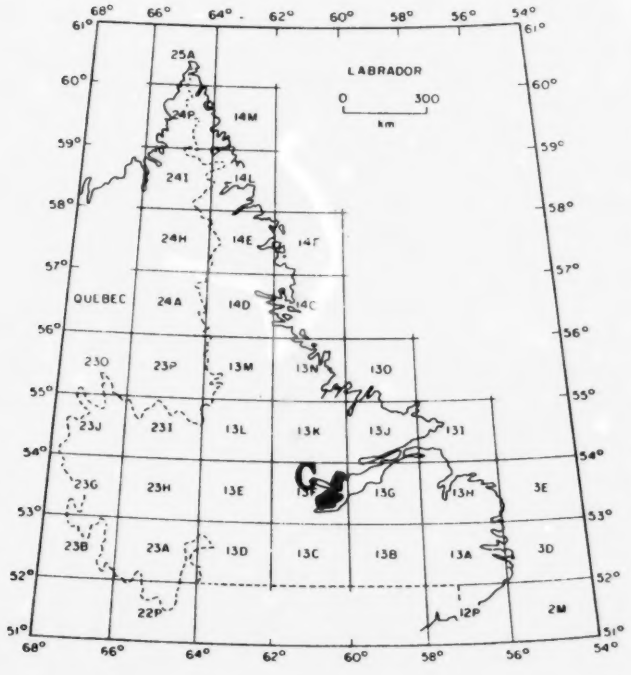

Figure 2. Labrador field area, 1986.

C. Happy Valley - Goose Bay - North West River (13F/7,8,9)

The study has verified that the Happy Valley - Goose Bay area is underlain by medium to fine grained sand, as determined by previous aggregate resource evaluations. Two gravel exposures were noted in quarries, but subsequent backhoe testpitting failed to intersect any gravels in the surrounding areas. Random backhoe testpitting was conducted in other areas, but failed to intersect any gravels. Exposures of gravel were located along both the Churchill Falls Road and the Goose River Road outside the municipal-planning area. Distance and road conditions would make these deposits presently unavailable to the Goose Bay - North West River areas.

A large reserve of stratified sand and gravel was sampled at North West River. The deposit is quite extensive and extends 8 km north of North West River. It is found in what appears to be an end moraine, covered by dense forest. Sampling in this deposit was conducted in existing quarry exposures, and by digging shallow hand-dug pits. In total, 96 samples were collected for particle-size and petrographic analyses. Random samples of sand were collected throughout the area for silica analysis.

References

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Wild Cove clay project and an aggregate-resource study in the Argentia - Placentia area

by

M.J. Ricketts
Quaternary Geology Section

Wild Cove clay project

In July, 1986, detailed sampling was conducted in the Wild Cove clay deposit near Corner Brook (Figure 1). This was a follow-up program based on reconnaissance samples collected in 1983, which showed positive results for the use of this deposit in manufacturing bricks.

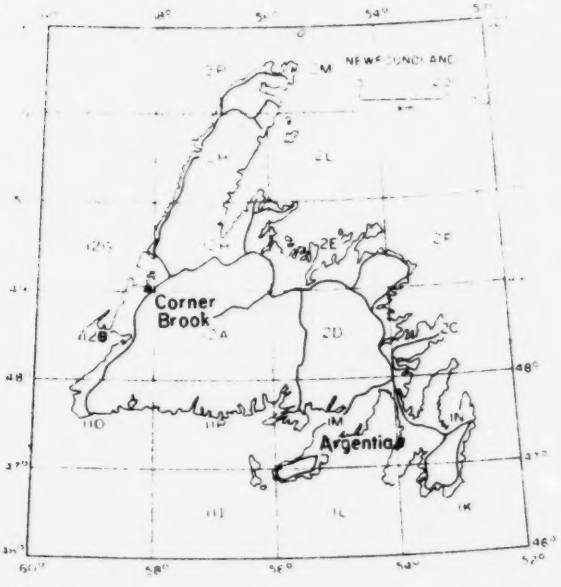

Figure 1. Location of study area.

The clay deposit is situated in a small steep-sided valley on the north side of Humber Arm. Dense to moderate tree growth and bog cover the valley floor. A narrow brook of less than 1 m average depth flows through the centre of the valley.

The clay deposit is approximately 1.5 km long and 1 km wide. Samples were taken above the 16-m contour line and at sea level, indicating a potential thickness of 16 m. Samples were collected along a 100- to 200-m grid system from backhoe-dug pits and shoreline exposures, and with a 1-m-long auger with a diameter of 3.5 cm. In total, 72 samples were collected for grain-size and geochemical analysis.

Aggregate-resource study in the Argentia - Placentia area

An aggregate-resource study in the Argentia - Placentia area (Figure 1) was conducted to provide detailed aggregate information for these areas, which may see increased aggregate demand resulting from industrial and economic activity stimulated by offshore oil development. The study area included the southeast corner of map area 1N/5, the northwest corner of 1N/4 and the northeast corner of 1M/1.

Field work usually involved off-road traversing conducted by foot and boat. All road work was conducted previously under the Inventory of Aggregate Resource Program. Where shoreline exposures were not available, hand-dug pits were made using a pick and shovel. Depths of one metre were usually required to reach below the B soil horizon to obtain an unweathered sample.

The study showed that the immediate areas around Argentia and Placentia are lacking in quality aggregate material, with the exception of a marine terrace near Moll Point. This small deposit is located on the United States naval base.

Deposits sampled are located at Broad Cove, Bottom Barasway, Sparrow Point, Little Barasway, Northeast Brook, Southeast River, Rocky Island Pond and Kellys Pond. Petrographic and grain-size analyses will be available for these deposits in the near future.

Silica Sand Project, Western Newfoundland

by

M.J. Ricketts and R. Bracken
Quaternary Geology Section

Part of the 1986 field season involved silica-sand sampling in western Newfoundland. The project was carried out in conjunction with the North Star Cement Company in Corner Brook. Its aim was to locate deposits of silica sand having geochemistry compatible with shale and limestone used in the production of cement. Work was concentrated in areas between Stephenville and Deer Lake (Figure 1).

Figure 1. Location of Study Area

Increased interest in the cement industry came about as a result of the potential high demand for cement in the development of the offshore oil industry. High-silica, low-alumina material is necessary if the cement plant is to produce any special portland cements, including those for concrete, offshore, oil-production platforms. Gravity-based platforms will require 100,000 to 150,000 tonnes of cement for each one constructed, depending on platform design.

The impact of offshore development upon the infrastructure, industrial, commercial and residential needs of the whole province will also dramatically increase the need for ordinary portland cement.

Shale comprises 20 percent of the raw mix used by the North Star Cement Company in the production of cement. Geochemical restraints on the type of shale used are: 1) a SiO_2: Al_2O_3 ratio greater than 4:1, (2) low levels of MgO, SO_3, K_2O and Na_2O, and (3) less than 1 percent sulfur content. The existing shale quarry located next to the plant has problems because of its geochemistry and variability. To counter this variability, North Star uses a pre-blended stockpile of shale and silica-rich sand to attain the desired high-silica content. A supply of silica-rich sand from the present quarry located near Steady Brook is nearing depletion; it has a 3 to 5 year life expectancy at present operation capacity.

High-silica "fines" discarded at ERCO's Long Harbour plant and high-silica quartzite rock in the Corner Brook area are available and chemically suitable. However, high transportation costs in the case of the former, and high quarrying and crushing costs for the latter, make them far from ideal.

Geochemical analyses of sand samples collected during the

'Inventory of Aggregate Resource Program' were used as a guide for field mapping. These samples, including reconnaissance samples collected in the early part of the field season, were analysed by the North Star Cement Company and provided the background data for detailed sampling in potential deposits. Generally, the higher the silica content in these deposits the better, but it should not be greater than 80 percent SiO_2, since a higher grade results in expensive crushing cost. Chemical uniformity is also important as the cost of blending equipment and procedures will be less for a more uniform material.

A number of deposits were sampled in areas between Stephenville and Deer Lake. These deposits have varying degrees of potential, based on analyses by North Star Cement. Deposits that show some potential are located at: (1) between John's Point and Dancing Point near the exit of the Humber River into Humber Arm, 12A/13, (2) the north side of the Humber River, west of Little Rapids, 12A/13, (3) near the intersection of Matthews Brook and the Trans- Canada Highway, 12A/13, (4) Northern Harbour on Grand Lake, 12A/13, (5) eight kilometres west of Harry's River on route 47, 12B/9, (6) Hughes Brook, 12H/4, and (7) the north side of Deer Lake at North Brook, 12H/4.

Several of these deposits are small or are located in areas of privately owned land. The largest deposit is located on the north side of Deer Lake near North Brook. Positive and negative results, based on mineral content, have come from this deposit. Final analyses will be done at the Department of Mines and Energy laboratory in St. John's.

Data compilations - Quaternary geology

by

B.J. Downton
Quaternary Geology Section

A. Geochronology (carbon-14)

Throughout 1986, compilation of carbon-14 data has been ongoing, with the aim of producing a 1:500,000 scale location map of carbon-14 dates for Newfoundland and Labrador.

The age range of these dates is from 100 ± 130 years B.P. to greater than 40,000 years B.P., with most occurring between 1,000 to 14,000 years B.P. Seven different types of material have been dated; these include wood, shells, peat, gyttja, whale bone, calcite crystals and charcoal. Symbols for these materials, the name of the laboratory performing the dating, the sample number and the carbon-14 date will be recorded on the map (see Figure 1). The sample sites occur, for the most part, near the coast, and the highest concentration is on the Great Northern Peninsula.

Of the almost 800 Carbon-14 dates compiled to date, approximately 500 relate to archaeological investigations, and most of these fall within a range of 100 to 9,000 years B.P. Since the number of archaeologically related dates is so great, commonly with several occurring at one site, it may be necessary to include smaller scale map inserts (so information may be clearly portrayed). However, due to the number

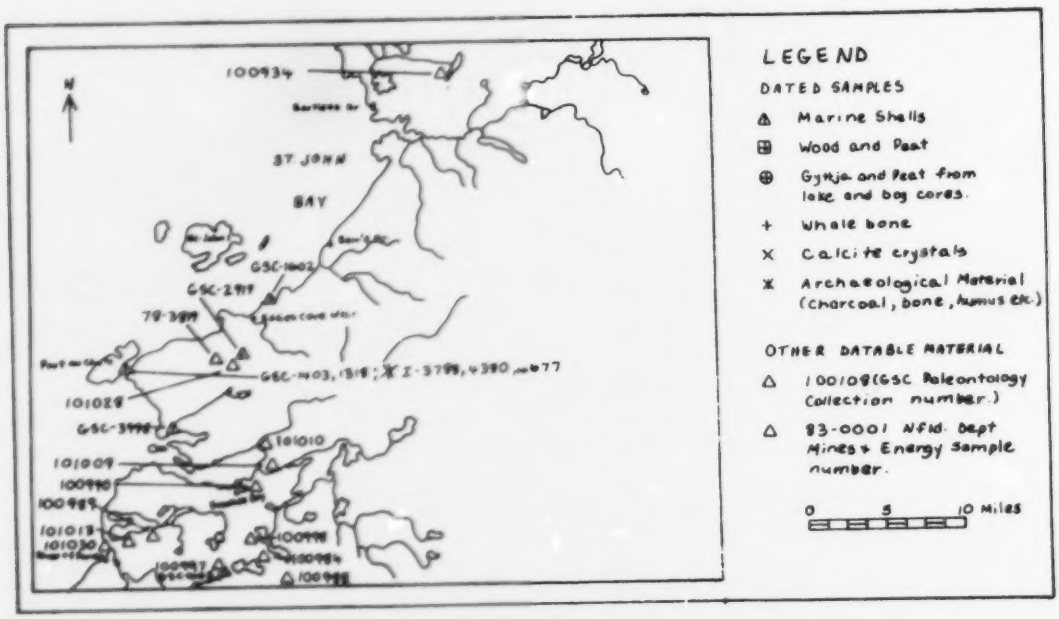

Figure 1. Example of a carbon-14 geochronology map from the Great Northern Peninsula, Newfoundland.

of archaeological dates, consideration is being given to the compilation of a separate map for them.

There are approximately 80 sample sites yet to be dated, and these will also be included on the map. This may enable other interested scientists to assess these materials for dating purposes. A series of tables containing all relevant information pertaining to each sample (i.e., Lab number, date, locality, location, elevation, publication reference, collector, material and significance) will accompany the map. These data are expected to be of value to Quaternary scientists who are interested in the Quaternary history of this province.

B. Glacial-flow maps

Glacial striae, landform and erosional features that provide information on the direction of glacial advance(s) are being plotted on a series of 1:250,000 scale maps. These data are being compiled from previous mapping (including striae recorded on geological bedrock maps), and are being continuously updated. These data should be useful to exploration programs in drift-covered areas, and give assistance in defining source areas for mineralized float. Blueline copies will be provided upon request.

Quaternary mapping and drift prospecting, Bellburns (12I/5,6) map area

by

David N. Proudfoot and Lloyd St. Croix
Quaternary Geology Section

Zinc mineralization is known to occur within the epigenetically altered upper part of the Catoche Formation (Crossly, 1982) in the Bellburns (12I/5 and 12I/6) map area. Following the detailed work of Mihychuk (1985) in the vicinity of the Trapper Prospect, a more regional exploration and Quaternary mapping project was initiated in 1986. The objectives of this project are to explore for zinc mineralization in the northern half of the map area, and to establish a regional Quaternary map and a stratigraphic framework that will provide a basis for future exploration, including a viable drift exploration technique for Mississippi Valley-type zinc deposits in the area. The approach involves airphoto interpretation, including follow-up field checking, digging backhoe pits for sampling and sediment description; geochemical and grain-size analyses of diamicton (mostly till) samples; and ultimately a sedimentologic interpretation of sediment distribution and genesis.

Geologic Setting

The map area lies along the west side of the Long Range Mountains. It is underlain by predominantly carbonate rocks of Cambro-Ordovician age. Zinc mineralization, exemplified best at the Newfoundland Zinc Mine, is of the Mississippi Valley stratiform type. It occurs in epigenetically formed pseudobreccia that follows paleokarst zones (matrix breccia) within the upper part of the Catoche Formation. Zinc mineralization also occurs to the north of the map area along the Boat Harbour - Watts Bight Formation contact (Knight, 1985).

Regional Quaternary Geology

Figure 1 shows the distribution of Quaternary sediment in the map area. Three sedimentary environments predominated in the deposition and modification of this sediment. Stratigraphic relationships are uncertain because of subsequent marine reworking and the lack of complete exposures, however, preliminary interpretation suggests the following glacial history:

1. One or more advances of piedmont glaciers from the Long Range Mountains coalesced to cover the entire area. This interpretation is based on the orientation of glacial grooves and striae on bedrock surfaces, pebble orientations in till, and the orientation of moraines.

2. Glacial retreat allowed marine transgression to at least position A (Figure 1) at about 90 m above sea level.

3. Glacial readvance of probable limited extent incorporated marine shells at site A (Figure 1) that are dated at 12800 ± 150 years B.P.(unpublished date, Newfoundland Department of Mines and Energy).

4. Marine transgression to about 122 m followed glacial retreat and resulted in the deposition of shell-rich pebbly mud, sand and gravel. As the ice retreated, there was substantial wave modification to glacial and marine sediment that left a discontinuous sand and gravel lag

LEGEND

1 Low-relief (less than 3 m), hummocky moraine complex containing till, sand and gravel; as much as 1 m of wave-washed lag occurs on the surface in some places

2 Low-relief (less than 3 m) moraine containing abundant cross-valley moraines; contains till, sand and gravel

3 Featureless sand and gravel plain of glaciofluvial origin

4 Sand and gravel plain containing abundant, low-relief (less than 2 m), cross-valley ridges that parallel similar ridges in Unit 2

5 A low-relief (less than 3 m) sand and gravel plain of glaciofluvial hummocky origin

6 Sand, gravel and pebbly mud that is mainly of glaciofluvial origin containing discontinuous patches (less than 3 m thick) of wave-sorted material

7 Gravel, sand and pebbly mud plain of marine origin - areas near the coast commonly have rock exposed; depression contains as much as 3 m of organic material on the surface

8 Boggy area that occurs in a large depression; peat is probably about 6 m thick

9 Bedrock

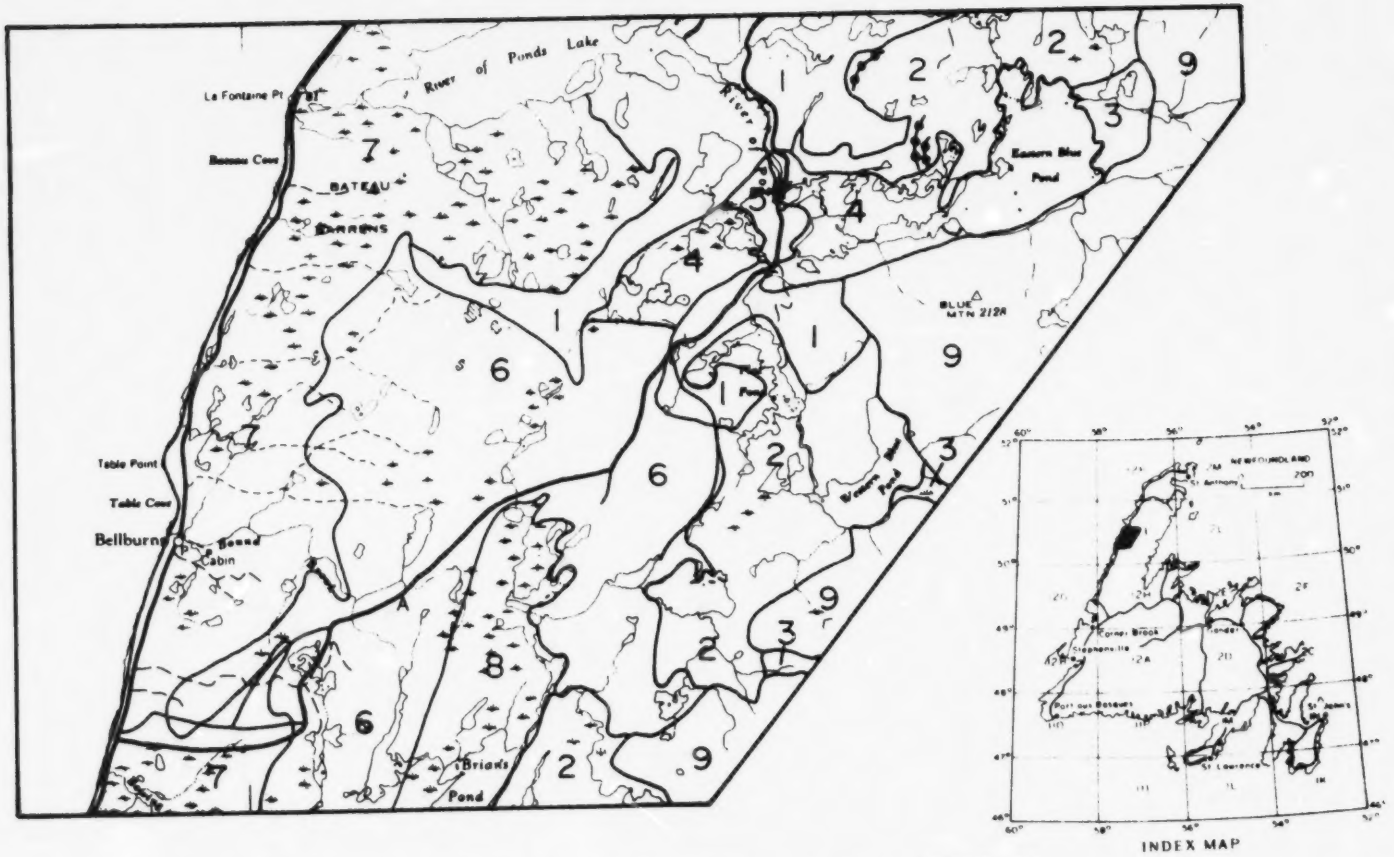

Figure 1. Quaternary geology of the Bellburns map area (12I/5,6)

veneer. Glaciofluvial deposition occurred in fans that were predominantly subaqueous. Although at elevations higher than about 122 m above present sea level, deposition of outwash occurred subaerially.

Drift Exploration

Within the Bellburns and the southern part of the Port Saunders map areas, six areas were explored for zinc. Each area is associated with known zinc mineralization or occurs at the most favourable stratigraphic level for mineralization. The target areas lie either directly down-ice of the epigenetically altered upper Catoche Formation, or along the contact between the Watts Bight and Boat Harbour formations, particularly near northeast-trending faults. Data collected from 87 backhoe and a few hand-dug pits include detailed sediment descriptions and samples for pebble lithological, geochemical and granulometric analyses. This information is being used to locate zinc-rich glacial dispersion trains, and to confirm the regional Quaternary stratigraphy, which will provide a framework for drift exploration.

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Quaternary mapping - La Poile (110/9) and La Poile River (110/16) map areas, southwestern Newfoundland

by

Byron Sparkes
Quaternary Geology Section

Introduction

During the 1986 field season, Quaternary mapping was conducted in the La Poile (110/9) and La Poile River (110/16) map areas (Figure 1). This project is a continuation of the provincially funded Surficial and Glacial Mapping Program, designed to provide information on glacial geology and till geochemistry as an aid to exploration in areas of mineral potential and/or exploration.

Geological Setting

The La Poile and La Poile River map areas are located in the southwestern corner of the eastern crystalline belt (Gander Zone) of the Newfoundland Applachians. The study area is mainly underlain by four metavolcanic and metasedimentary sequences: the Bay du Nord Group, the La Poile Group (hosting the Chetwynd gold deposit), the Billiards Brook Formation, and the Keeping Gneiss. These units are intruded by several generations of granitoid rocks,the most prominent of which are the Rose Blanche Granite and the La Poile Batholith. All units were affected by east-northeast-trending fault systems, such as the Cape Ray and Bay D'est faults (Chorlton, 1978, 1980).

Physiography

This area is part of the Atlantic Upland physiographic subdivision of the Canadian Appalachian region (Twenhofel and MacClintock, 1940), and the topography is controlled largely by rock type and east-northeast-trending structural grain.

The northwestern part of the area, west of La Poile River and Bunker Hill Brook, is characterized by a gently rolling upland, underlain mainly by the Rose Blanche Granite. This upland surface has an altitude ranging from 520 m in the northwest corner to about 200 m in the area west of La Poile River. The southeastern half of the area is rugged and irregular; altitudes range from 450 m in the northeast to about 250 m in the southwest. This area is underlain by metamorphosed felsic volcanic and sedimentary rocks, amphibolite, gabbro and granitoid intrusions. The Iron Bound formation (granite, diorite), at the eastern margin of the map area forms the highest hills in the area (593 m) and is a prominent landmark.

Regional Quaternary Geology

Figure 1 outlines the distribution of glacial sediments in the field area. The north-central part of the area is characterized by low-relief hummocky deposits and a thin bouldery ground moraine (Units 4, 5). These deposits are devoid of any linear elements and appear to have a chaotic arrangement. They probably owe their origin to both direct basal deposition and ice wastage.

The most widespread depositional features are streamlined forms parallel to ice flow (see symbols), which commonly occur in areas totally lacking in other sediment types. These features are thought to be subglacial forms, which represent complex interactions between erosional and depositional processes.

LEGEND

QUATERNARY

1 Colluvium deposits; usually angular material of any particle size, accumulated on the lower parts or the base of slopes and transported by gravity through cliff failure and mass-wasting

Non-glacial environment

2 Sand to bouldery gravel alluvium, up to 2 m in thickness, in the form of terraces and plains that formed as stream channels and floodplains; usually found in the larger valleys and may overlie glaciofluvial sediments

Pro-glacial environment

3 Ice-contact or glaciofluvial deposits that consist of gravel and sand in the form of hummocks, terraces and plains, usually within valleys

Glacial environment

4 Hummocky moraine (1 to 10 m thick), usually consisting of till having a sandy matrix, but may be composed entirely of boulders; appears to be of a complex origin, possibly the result of ice disintegration

5 Undifferentiated till veneer, commonly discontinuous and less than 2 m thick; in some areas it may consist entirely of boulders and includes colluvium deposits in deeply incised valleys

6 Linear till forms, consisting of silty clayey lodgement till, overlain by a thin (1m) mantle of a more sandy meltout material containing more boulders; the most common form is long flutes having an almost flat profile - other forms include till ramps and ramped crag-and-tail hills (see symbols)

PRE-QUATERNARY

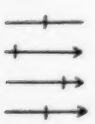
7 Bare rock exposed or obscured by vegetation; includes areas of boulder-strewn bedrock

SYMBOLS

Direction of regional ice flow
Striation ice direction known, unknown

Cirque

Longitudinal ice-flow features



Drumlinoid, fluting
Crag-and-tail hill
Till ramp
Till ramp with tail

Transverse ice-flow features

Crestline of moraine

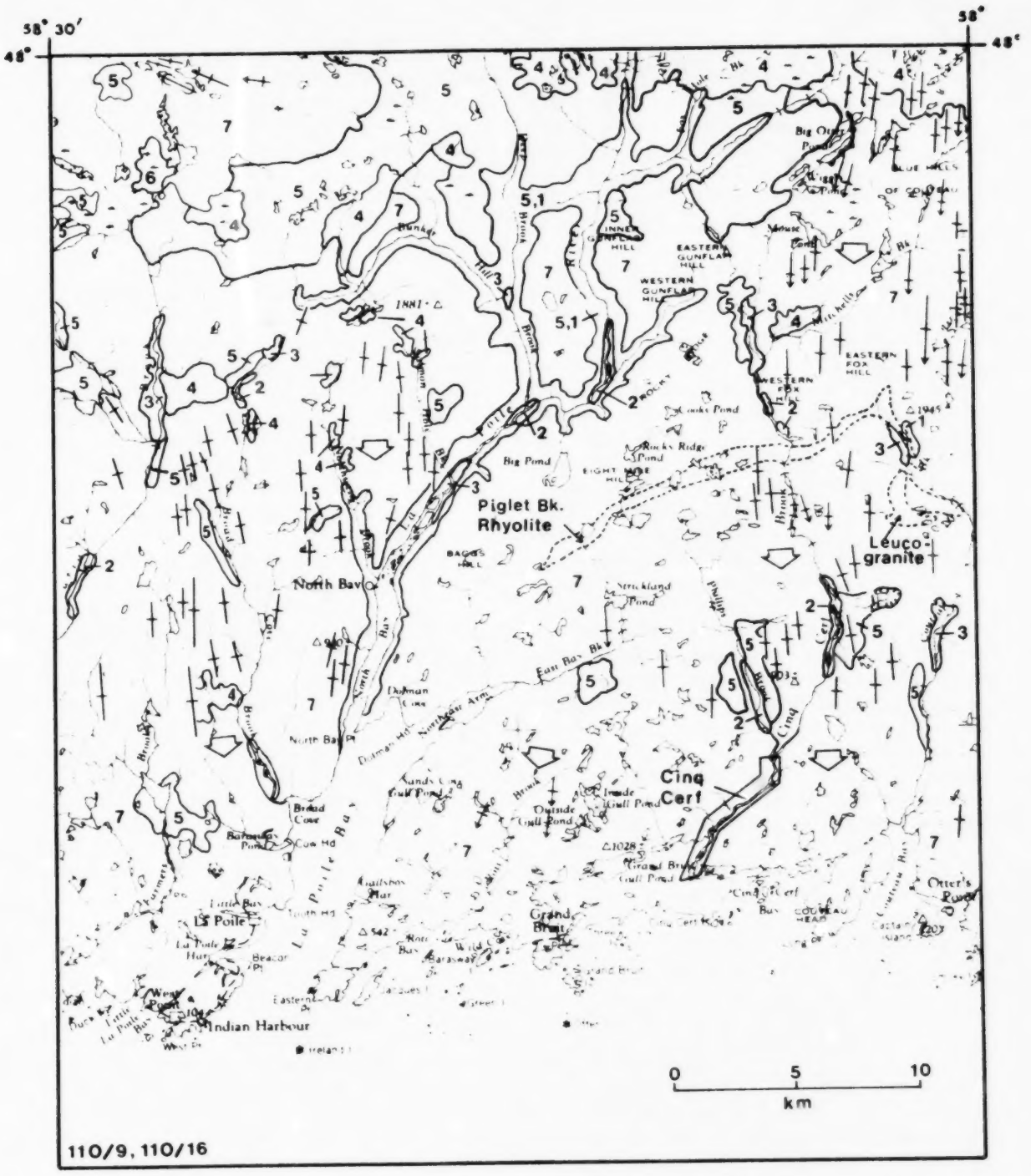


Figure 1. Quaternary geology of the La Poile (110/9) and La Poile River (110/16) areas.

Ice flow in the area was generally to the south (170-180), as indicated by numerous longitudinal depositional forms and striations. Minor redirection of ice caused by topographic control is evident in the vicinity of North Bay and La Poile Bay. In the northwest corner of the area, a west-northwest movement probably represents flow into St. Georges Bay in response to regional slope.

Field Program

The delineation of landform types, and detailed sampling, was the main emphasis of the field program. Five hundred and thirty matrix samples were collected from shallow (75-100 cm) hand-dug pits, on an approximately 2 x 2-km grid spacing. As well, a representative pebble fraction was obtained at 150 sites, and the rock types were referenced to a bedrock map unit where possible. Many of these samples were taken from lodgement till south of the Piglet Brook Rhyolite, and from a small area of leucogranite (Figure 1). These rocks will be used as tracers to determine the distance of transport within the subglacial zone.

A limited sampling program was undertaken within the lower part of the Cinq Cerf River valley. Samples of alluvial and glaciofluvial sediments were collected to determine the degree to which gold from the Chetwynd deposit is present in the modern river sediments and the older outwash materials.

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Quarternary mapping - west half of the Gander River (2E/2W) area, Newfoundland

by

D.G. Vanderveer and D.M. Taylor
Quaternary Geology Section

Introduction

The Gander River Ultrabasic Belt (GRUB Line) recently has been the target of exploration for gold mineralization. The area generally has an extensive cover of overburden, and outcrops are generally scattered or restricted to streams and some hilltops.

The main objectives of this study are to determine the distribution of surficial landforms and the direction of glacial transport, and to assess the effects of the glacial dispersal of gold in this depositional environment.

Regional Setting

Most of the gold exploration in the area is centred in the Gander River Ultrabasic Belt, which consists of medium to coarse grained pyroxenite, serpentinite, magnesite and talc/tremolite schist, mafic flows, fine to medium grained volcaniclastic rocks, fine to coarse grained trondhjemite, and quartz and quartz-feldspar porphyry (Blackwood, 1982). The GRUB Line is bounded on the west by conglomerate, sandstone, siltstone, and gray to black and minor red slate of the Davidsville Group. Semipelite, pelite and psammite of the Gander Group (including minor mafic tuff or amphibolite bands) occur to the east of the GRUB Line.

Surficial Landforms

The distribution of the surficial geology landforms may be summarized as consisting of a continuous mantle of till, generally 1 to 5 m thick, over most of the study area, with up to 5 to 10 m of till in local areas (based on hammer seismic survey). Some of the major river valleys contain deposits of glaciofluvial sediments.

Glacial Transport

Mapping of glacial features (Figure 1), such as striae, indicate that there were two regimes of glacial flow in the study area; an earlier flow toward the east (080 to 100) and a later flow generally toward Gander Bay to the north (000 to 030).

Conclusions

Till- and soil-sampling programs in the Gander River area may require further detailed orientation till-sampling studies, preferably in the vicinity of established showings, in order to define the pattern of glacial dispersal in this area.

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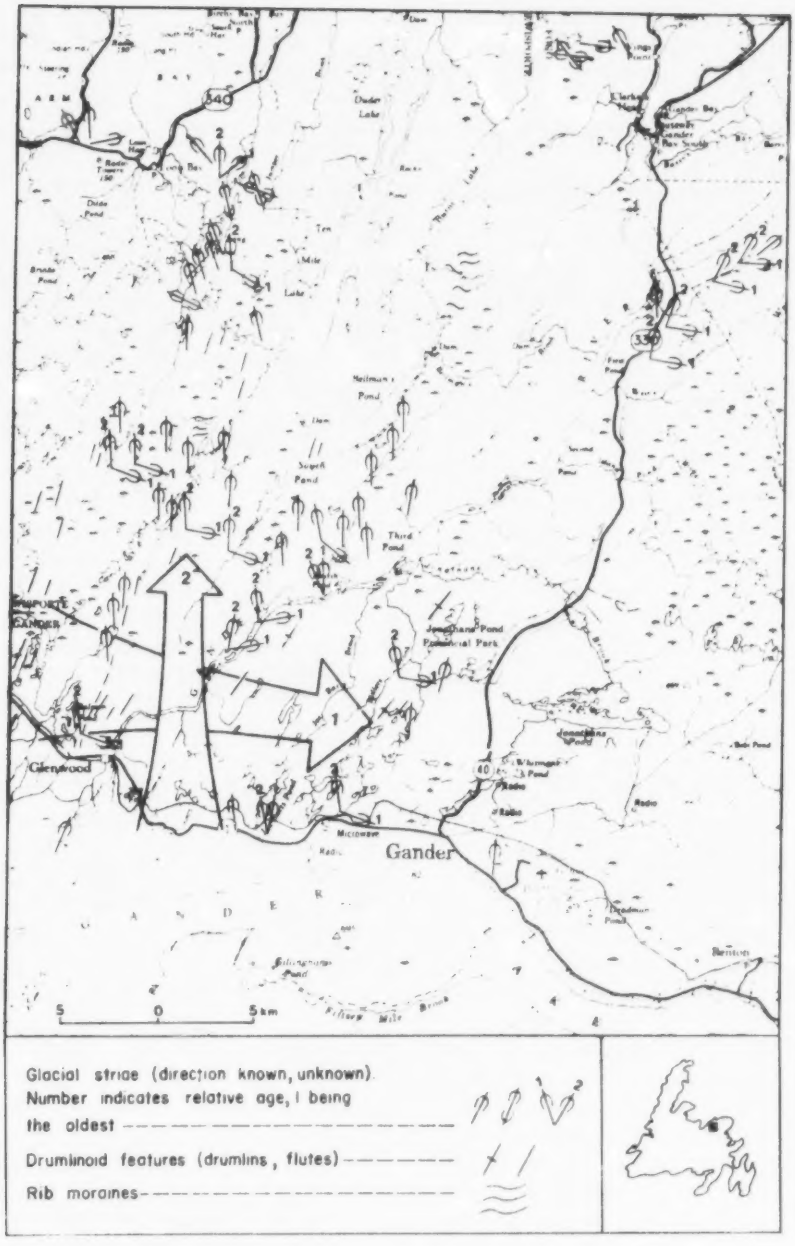

Figure 1. Glacial flow, Gander area.

Quaternary mapping/drift dispersal study - Sops Arm (12H/10) area, Newfoundland

by

D.G. Vanderveer and D.M. Taylor
Quaternary Geology Section

Introduction

The Sops Arm area has been the scene of gold exploration and some limited mining, dating back to the early 1900's. The recent interest in gold has brought about a revival of gold exploration in this part of the province.

The main objectives of this study are to determine the distribution of surficial landforms and the direction of glacial transport, and to assess the effects of the glacial dispersal of gold in this depositional environment. In the latter regard, a companion report by McConnell (this volume) is designed to deal with the nature of the geochemical response of gold in soils and other sample media.

Regional Setting

The silicic tuffs of the Sops Arm Group host the Unknown Brook, Browning and Simms Ridge prospects. These tuffs (Tuach, 1986) were subjected to carbonate-sericite-chlorite alteration. The volcanic rocks are bounded to the west by the Long Range granitoids, which include the Devils Room Granite (contains fluorite mineralization), and to the south by the Gull Lake Intrusive Suite. Carboniferous sedimentary rocks of the Deer Lake and the Anguille groups occur in the southern and eastern parts of the study area respectively.

Surficial Landforms

Figure 1 outlines the distribution of the surficial geology landforms within the study areas. These may be summarized as consisting of generally thin to discontinuous till and barren outcrop in the higher terrains, a continuous mantle of till, 1 to 3 m thick, over most of the remaining areas,and up to 5 to 10 m of till in local areas. Nearer sea level in certain valleys, deposits of glaciofluvial or glaciomarine sand, gravel and/or silt and clay are present.

Glacial Transport

Mapping of glacial features (Figure 2), such as striae, indicate that there were two regimes of glacial flow in the study area; an earlier flow toward the east (080 to 110) from a centre in the Long Range, and a later flow toward the north-northeast (020 to 050) from a centre or ice divide whose main mass was located farther to the south.

Glacial Dispersal

The variable nature of these two glacial flows raises questions concerning the resultant pattern of glacial dispersal. Two sampling programs along grids were undertaken to define the dispersal; one over the Browning Mine and the other over the Wizard prospect. The latter sampling program had the cooperation of John O'Sullivan of Esso Minerals in providing access to the showing, which is exposed in a road cut along the road to Sop's Arm.

In both areas, a till-sampling program was carried out over a grid that extended over the showing in a northerly direction, parallel to the regional structure and sub-parallel to the most recent glacial flow.

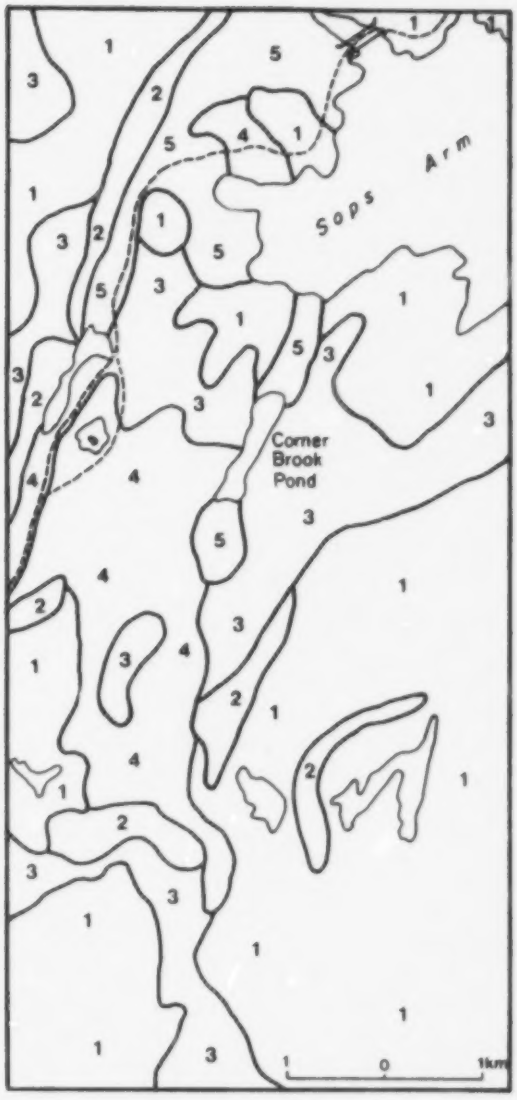

Figure 1. Distribution of Quaternary sediments, Corner Brook Pond area, Sops Arm. Unit 1, bedrock; Unit 2, colluvium and talus; Unit 3, till, 1 to 5 m thick, thin and/or discontinuous; Unit 4, till, commonly 5 to 10 m thick; Unit 5, glaciofluvial sediments, underlain by shell-bearing marine silt and clay in some areas.

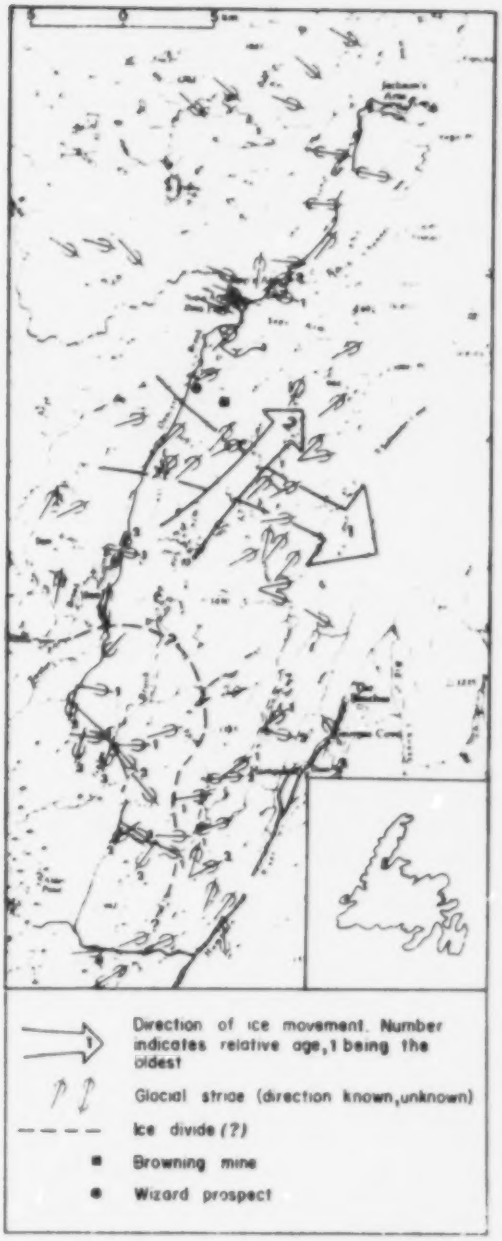
Direction of ice movement. Number indicates relative age, 1 being the oldest
Glacial stride (direction known, unknown)
Ice divide (?)
Browning mine
Wizard prospect

Figure 2. Glacial flow, Sops Arm area.

Sampling was conducted, for the most part, along lines spaced 100 to 200 m apart, at intervals of 50 to 100 m along the line. Pebble samples will be analysed for lithological composition, and matrix samples for textural (grain size) and geochemical variations, to assist in the definition of glacial dispersal patterns.

Sampling was conducted, for the most part, along lines spaced 100 to 200 m apart, at intervals of 50 to 100 m along the line. Pebble samples will be analysed for lithological composition, and matrix samples for textural (grain size) and geochemical variations, to assist in the definition of glacial dispersal patterns.

Conclusions

Prior to this investigation, it was generally assumed that the last glacial flow to affect the area was to the north and generally parallel to the regional bedrock structure. Since the gold mineralization is thought to generally occur along these structures, the value of till- and soil-sampling programs was of dubious value in defining individual dispersal patterns.

It is now known that the major erosional and depositional glacial-flow directions were transverse to the regional bedrock structure. Therefore, a till-sampling program will be of benefit in discerning between individual areas of anomalous gold values by providing a larger target zone. Data analyses and compilation are ongoing.

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Quaternary mapping and drift exploration in the eastern part of the Central Mineral Belt, Labrador

by

Martin J. Batterson
Quaternary Geology Section

Introduction

The granitoid terrane in the eastern Central Mineral Belt has long been the focus of significant mineral exploration. The uranium deposits of Kitts and Michelin, and numerous uranium and other base-metal showings have resulted from more than 25 years of exploration, mostly by BRINCO. However, many high-grade ore boulders were discovered that are still not related to any known source; those around Melody Hill are a case in point.

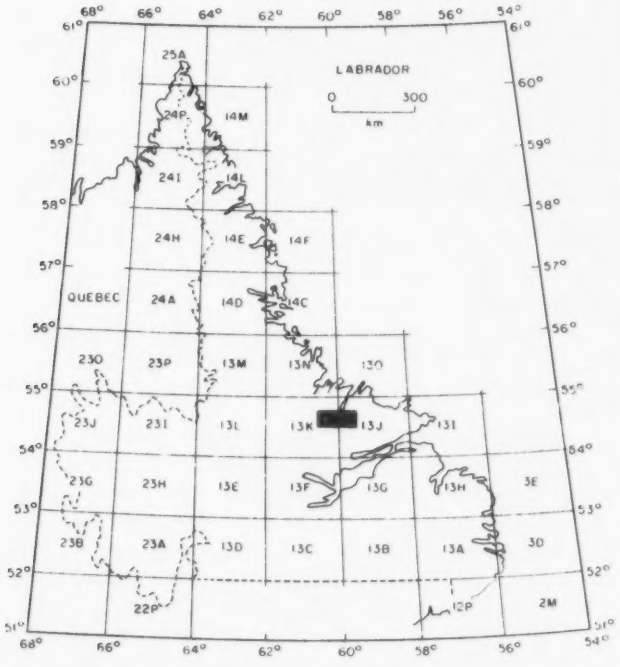

Figure 1. Location of field area.

The aim of this project is to map the Quaternary geology of an area comprising 1:50,000 scale, NTS map areas 13K/9 and 13J/12, a total area of about 1,850 km2 (Figure 1). Through this study, the distribution and characteristics of individual Quaternary units will be identified, and their relationship to the glacial history (and hence their affect on mineral exploration problems) assessed.

Location, Access and Geology

The field area is situated approximately 90 km north-northeast of Goose Bay. Access is by helicopter or float plane, although the northern part of the area may be reached by boat along the Kaipokok valley. Postville lies just to the north of the field area. Base camp was at the BRINCO mining camp at Melody Lake.

The area includes rocks ranging in age from the Archean to the middle Proterozoic. The northwest corner of the field area comprises Archean gneisses, whereas the southeast section is dominated by Grenville Province gneisses. The central portion, between Walker Lake and Mclean Lake, is composed of supracrustal rocks of the Aillik Group. The remaining area contains a wide variety of granitoid rocks, some of which are foliated (Makkovikian) and some are more massive units (Trans-Labrador batholith).

Field Program

The project had several major themes:

1) Delineation of terrain units. This phase involved mapping on

an approximate 2 by 2-km grid, but also included investigation of all areas of interest. At each survey site, a detailed description of the area and the overburden was made, and a sample was taken of the parent material. In some cases, however, the bouldery nature of the overburden hampered sample collection. Samples were taken for confirmation of their genetic environment and for use in generating dispersal patterns through geochemical analysis.

2) Transport distance and direction. Ice-flow directions were determined through a variety of erosional and depositional features. Striations and grooves provided good data, although the inconsistent bedrock distribution, especially through valleys, commonly biased the results. Another source of direction data, and one which produces a handle for transport distances, is lithological analyses. If a rock unit has a discrete source area and is distinctive in its characteristics, it is considered suitable. Several such units occur to the west of the field area and were used successfully during the field program. These include: red and gray chert from around Croteau Lake, plagioclase porphyry from around Camel Lake, Crooked River granite, Bruce River Group volcanic rocks and sandstone, Seal Lake Group quartzite, and several others.

3) Glacial history. Through an analysis of the terrain units and the flow information outlined above, the glacial chronology of the area can be inferred. It is clear at this stage that a major flow event trended approximately northeast across many of the major valleys. Subsequent deposition emplaced a series of cross-valley moraines within the lowlands, but whether these represent an advance phase (i.e., subglacially deposited ridges) or are recessional features (i.e.,terminally constructed ridges) is open to speculation.

4) Mineral exploration. The resolution of glacial chronology and an insight into terrain units and their individual characteristics are of distinct benefit to the mineral exploration industry. Lack of this knowledge has, in the past, led to many erroneous conclusions as to the origin of mineralized float, and has resulted in unnecessary expenditures.

Quaternary Studies in Labrador[1]

R.A. Klassen and F.J. Thompson

Geological Survey of Canada
Terrain Sciences Division
Ottawa, Ontario, K1A 0E8

The study is part of an ongoing project funded by Federal-Provincial agreements since 1982 (Klassen, 1983, 1984; Klassen and Bolduc, 1984, 1986; Thompson and Klassen, 1986). The major objectives of the work are to determine the history of ice flow and composition of glacial drift as a basis for developing techniques of drift prospecting. Quaternary studies have been concentrated in areas of Labrador considered to have the greatest mineral potential and include the Central Mineral Belt, Labrador Trough, and Flowers River area. Compilation of geochemical analysis of till for the 1986 project is in progress; geochemical results for earlier work in NTS areas 13 J,K,L and N are available on Geological Survey of Canada Open Files 1318, 1319, 1320 and 1282. The Open File reports record high background and anomalous levels for Pb, Zn, Mo, U, Be, Zr, Nb, Y, Ce in till derived from the Red Wine Alkaline Intrusive Suite and Letitia Lake Volcanics; for U, Pb, Mo in till derived from the Aillik Lake Group; Zn in till derived from the Moran Lake Group and the Archean granites near the contact with the Moran Lake Group; for Zn in till along the eastern margin of the Harp Lake Complex; and for Cu, Zn, Cr in till associated with the Archean Florence Lake Group. Mapping of principal glacial landforms at 1:1 000 000 scale and development of a computer-based file of ice flow trends for map areas at 1:250 000 scale are in progress.

During the 1986 field season Quaternary studies were conducted in the Labrador Trough and Archean highlands west of the trough, in the Flowers River area, and in the eastern part of the Central Mineral Belt. Studies in western Labrador indicate a complex history of ice movement. The oldest flow event recorded in the area is to the northeast and southwest from one or more centres either in or near to the Labrador Trough. This is demonstrated by older striae and by the distribution of Labrador Trough erratics more than 100 km both to the east and west of the trough. This earliest phase of flow is followed, in order, by northward ice movement across the Archean highlands into the Labrador Trough, ice flow to the northwest and southeast from a migrating centre in the Schefferville area, ice flow to the east across the Archean highlands and southern part of the Labrador Trough, and a relatively minor (late-glacial) phase of northeast-directed ice flow across the Labrador Trough. These ice flow events are considered to reflect changes in the configuration of the Laurentide Ice Sheet and may all be related to Wisconsin glaciation. Several Quaternary sections exposed by mining operations in the Labrador Trough were studied and show a previously unrecognized stratigraphic sequence of tills that reflects the multiple ice flow events. Studies of two large (60 km) eskers and their compositional relation to till have been done in the area of Churchill falls by A.M. Bolduc and E. Evesson, Lehigh University.

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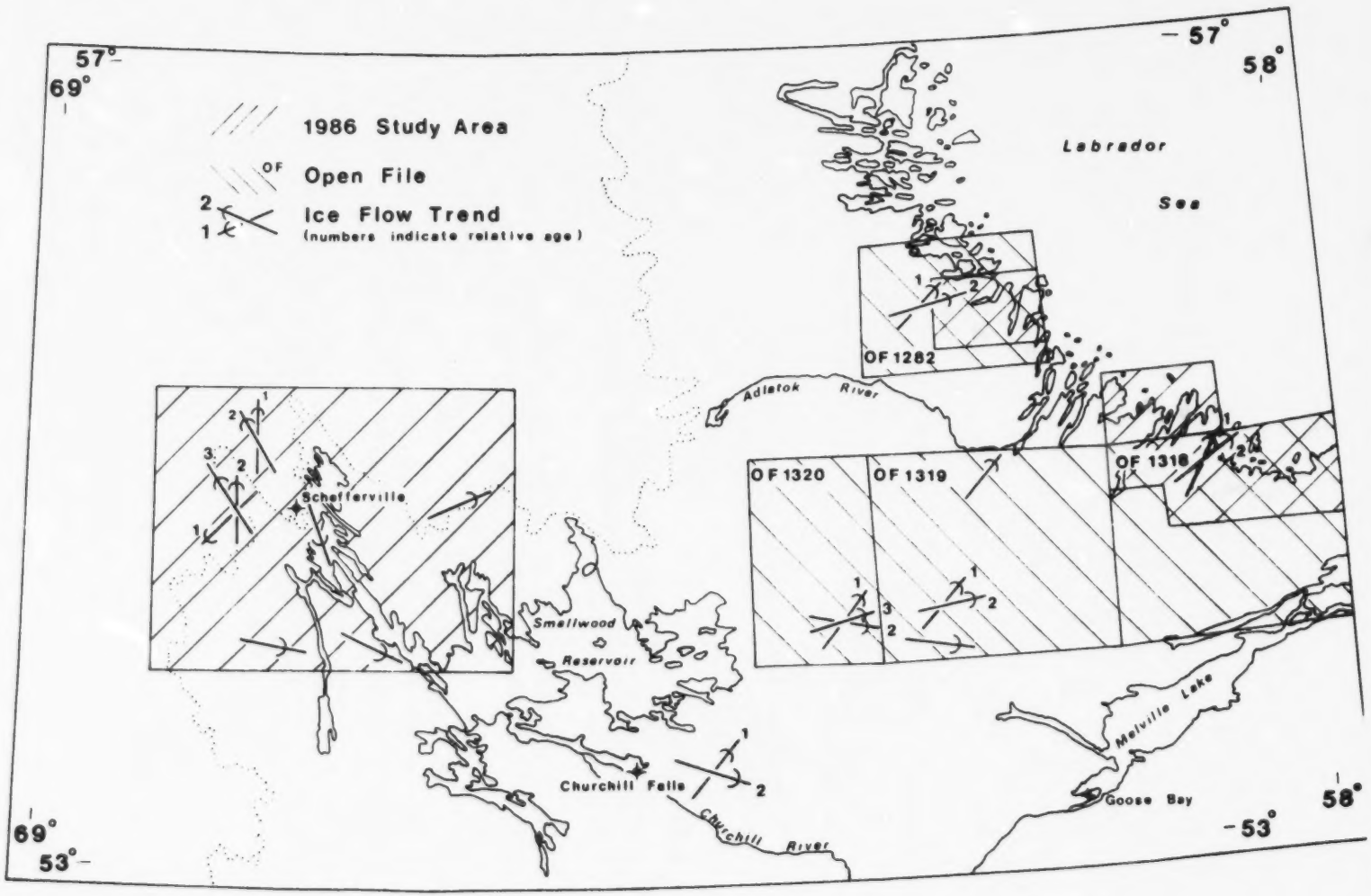
[1]Contribution to the Canada-Newfoundland Mineral Development Agreement. Project carried by Geological Survey of Canada.


1986 Study Area
OF
Open File
Ice Flow Trend
(numbers indicate relative age)
57°
69°
57°
58°
Labrador
Sea
OF 1282
Adlatok River
OF 1320
OF 1319
OF 1318
Schefferville
Smallwood
Reservoir
Churchill Falls
Churchill River
Melville Lake
Goose Bay
69°
53°
53°
58°

Glacial transport directions, drift composition, and shape of dispersal trains can reflect transport during more than one phase of ice flow. Glacial erratics in surficial deposits can be traced for several 10's of km from their bedrock source. For example, drift on the Archean highlands northwest of Schefferville is primarily of Labrador Trough derivation and was transported primarily during the older southwest flow and not the later northwest phase. Patterns of glacial dispersal in western Labrador vary from broad fans to radial from bedrock sources depending on the location of the source relative to former dispersal centres.

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GENERAL PROJECTS

GEOSCAN - THE NATIONAL DATABASE FOR GEOLOGICAL INFORMATION

Catherine Patey
Publications and Information Section

GEOSCAN is a computerized bibliographic database of Canadian-produced and/or Canada-related geoscience documents.

The Newfoundland Department of Mines and Energy is one of the ten agencies that index documents for input into this databse. Our Mineral Assessment Report Library files and mineral inventory cards are the sources of our indexed documents. Other agencies, e.g., the Geological Survey of Canada and the Earth Physics Branch of the Canada Department of Energy, Mines and Resources, also produce and index documents that concern this province.

In 1982, the National GEOSCAN Centre, which manages GEOSCAN, implemented a new software system, and most of the old records were converted to a new format.

During the past year, detailed modifications of almost one half of the converted assessment-file records were made online.

All of the 92,600 GEOSCAN records from across Canada, including those concerning this province, are available through online computer searches at the Geological Survey of Canada Library in Ottawa, and in St. John's at our Publications and Information Section.

CORE STORAGE PROGRAM, 1986

by

A. Harris and S. Cochrane
Publications and Information Section

During 1979, the Newfoundland Department of Mines and Energy started a drill core collection and storage program. The objective is to provide well maintained and representative collections of drill core from as many drilling programs as possible for the future use of the mineral exploration industry, government geoscientists, university geoscientists and other geotechnical people.

Drill Core Collection

During the 1986 field season, drill core collection continued in insular Newfoundland, and in eastern Labrador. In insular Newfoundland, 7,436.9 m of core were acquired from eleven drilling projects, and in eastern Labrador 1,600 m of core were collected from four drilling projects in the Makkovik area. To date, the core storage program has collected 182,679.2 m of drill core, of which 145,868.9 m are classified as "open" and are available for inspection by interested persons.

The core storage program is presently storing 36,810.3 m of core from twenty drilling projects on a confidential basis. Requests for confidential storage are treated on an individual basis. Conditions and terms of contidential storage are tied to land status, and are similar to the terms and conditions of confidentiality that apply to assessment reports.

Drill Core Libraries

The Department of Mines and Energy operates three drill core libraries, located in St. John's, Pasadena and Goose Bay.

The St. John's library is staffed on a full-time basis, except during the field season. It has a capacity of 60,000 m of drill core. Approximately 34,300 m of drill core are being stored in the St. John's library. Most of this core is from eastern Newfoundland, from the St. Lawrence area and the "silica survey" drilling conducted by the provincial government during the 1960's. Drill core logs and location maps have been prepared for catalogued core. The St. John's library also contains rock-cutting equipment, core splitters, a stereomicroscope, a magnetic susceptibility meter, a resistivity meter, an ultraviolet light and a McPhar TV-1 scintillometer. These facilities and equipment are available for use on approved projects by exploration geologists, university researchers, the staff of the Department of Mines and Energy and other interested persons.

The Pasadena core library is also staffed on a full-time basis. This library has equipment and facilities similar to the St. John's library and has a capacity of 200,000 m of core. It has a ventilated room for storing radioactive core and a humidity-controlled room for storing salt core. There are approximately 133,568.5 m of core presently stored in the Pasadena library, collected from drilling sites west of Gander.

The Goose Bay core library, which contains core from Labrador, is not staffed on a full-time basis. It has a capacity of 60,000 m of core, with room for expansion. Approximately 11,713 m of core have been catalogued and placed on the rack system to date.

Plans

All "open" drill core in our three core libraries has been catalogued, and a drill hole map index and computer listing of this core is available as Open File Nfld 1479.

An extension to the Pasadena core library is in the planning stage. Limited space is available in all three core libraries for confidential storage of core. We encourage explorationists to use our facilities for core storage and related research.

Plans to rent core storage space in Springdale are in progress. During 1987 work is planned in Buchans in the core storage building being donated to the Department by the Buchans co-tenancy of ASARCO and Abitibi-Price. It is anticipated that most of the core samples now being stored by the Buchans co-tenancy will be donated with the core storage building.

Activities of the Computer Unit

by

Harj Missan
Computer Unit, Geochemistry and Geophysics Section

The Mineral Development Division is responsible for collecting, archiving, and processing large quantities of geological, geochemical, geophysical, mineral deposit and surficial geology data for evaluation of the mineral resource potential of the Province. Because of the increase in the volume and complexity of these data, sophisticated computer programs are being used in their analysis. Some of the programs and their applications that are used by the staff of the Division are:

SPSS-X for management of geological and geochemical data
SAS for management of geochemical and geological data
GRASP for management of mineral deposit data
SIR for management of surficial geology data

In addition, plotting programs are used for display of spatial distribution of samples and the various chemical elements.

Over the last thirteen years, the Division has been using the Newfoundland and Labrador Computer Services (NLCS) mainframe IBM/AMDAHL computer for data processing. NLCS is a service organization for all departments of the government. The majority of these organizations' needs are not scientific, e.g., motor registration system, payroll system, etc. Hence the main emphasis of the NLCS services and development has been in business applications. However, the needs of the Division are scientific, and it is becoming increasingly difficult for NLCS to meet satisfactorily the scientific requirements of the Division. The need for interactive systems like GRASP is imposing additional restrictions on the system, which is geared mainly for batch processing.

To meet the increasing demands that various geoscientific activities and specialized computer applications are imposing on the computing resources of the Division, the Division has purchased a multi-user UNIX-based computing system and five MS-DOS Operating System computers. A multi-user system is a central-system concept in which a centrally located computer serves a variety of users and drives a variety of devices. All of the computing power of this type of system is concentrated in the central CPU. One machine must effectively process the full spectrum of applications for the entire organization. In addition, the MS-DOS computers will be capable of serving as stand-alone microcomputers, as well as acting as terminals to the central UNIX System. This will allow the geologists to download their data from the UNIX machine and allow them the capability of working with data using programs and application programs with which they are familiar.

The UNIX System purchased by the Division is the Hewlett-Packard HP 560, which is a 32-bit machine and has 8 MBytes of main memory. In addition, it has:

i) 260 MBytes of disk space
ii) 1600 bpi tape drive
iii) an E-size (36" x 48") plotter
iv) a console CRT terminal
v) 3 graphic terminals

The operating software is HP-UX, which is compatible with A.T. & T's UNIX release V.2 version. The following application packages will be operational on the UNIX machine:

i) SPSS-X
ii) GRASP
iii) MAPGEN

SPSS-X is a commercially developed database management and statistical analysis package. It is used by a large number of geologists.

GRASP is an interactive file management system developed by the U.S. Geological Survey, and is used for operating the Mineral Occurrence Data System.

MAPGEN is a plotting package developed also by the U.S. Geological Survey. It will be used for plotting of spatial data and contouring.

Five MS-DOS Hewlett-Packard AT-compatible machines have been bought; one for each of the sections. Word-processing packages, SPSS-PC, MICRO-GRASP, SPF editing and other programs will be installed on these machines so that the geologists will be able to work independently on these computers.

Report of the Geochemical Laboratory for 1986

by

H.A. Wagenbauer and P.H. Davenport
Geochemistry and Geophysics Section

The output from the laboratory for the 12 months ending August 31st is summarized in Table 1. The number of determinations represents a 35 percent increase over 1985, and is 19 percent more than 1983, the second busiest year ever for the lab. The laboratory is now working at full capacity, given current budget and staffing levels, and is unable to meet fully the demand from the Division for analyses; as of August 31st, 1986, work resulting from the 1985 field season was only about 70 percent complete. Because of the demand for analyses, virtually no new methods-development work has been carried out over the past year. Part of the increase is due to the use of the inductively coupled plasma spectrometer (ICP) for the determination of refractory trace elements in rocks (Y, Zr, Nb, La, Ce, Th) together with Ga. These elements were previously determined in outside laboratories by X-ray fluorescence. Routine I.C.P. analyses commenced in January, 1986.

Table 1. Summary of the output from the geochemical laboratory of the Mineral Development Division from September 1, 1985, to August 31, 1986

	Number of Determinations
Geochemical analyses of soil, till, lake and stream sediments	40,957
Silicate analyses	
Major elements	46,916
Trace elements (A.A.)	26,795
Trace elements (I.C.P.)	14,735
Miscellaneous analysis	
Assays, F, Ba, Sr, H_2O, CO_2 and S on a variety of sample types	1,255
TOTAL	130,658
	Number of Samples
Sample Preparation	
Rock samples crushed	3,964
Rock samples pulverized	5,321
Lake, stream and soil samples sieved	3,380
Miscellaneous	
Sample splitting, uranium weighing, samples shipped out for analysis	6,167